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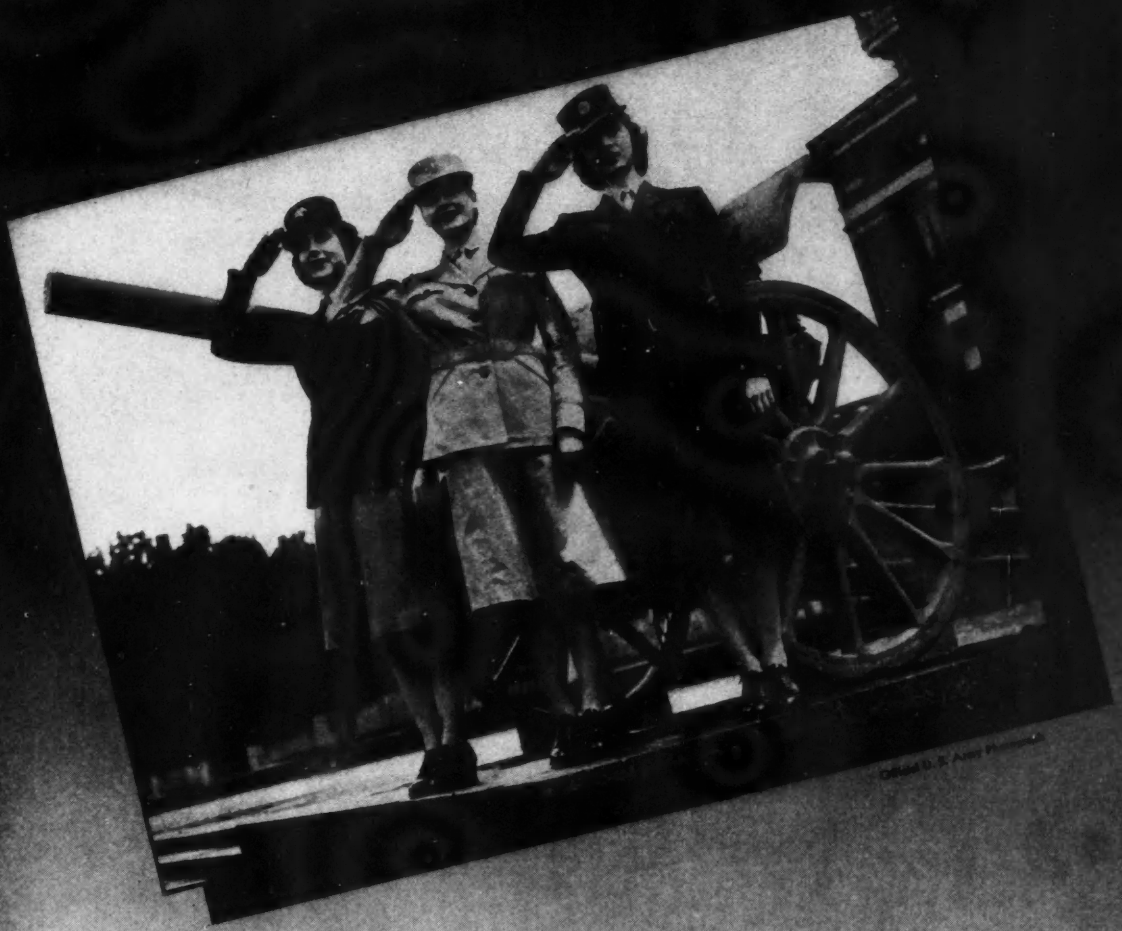

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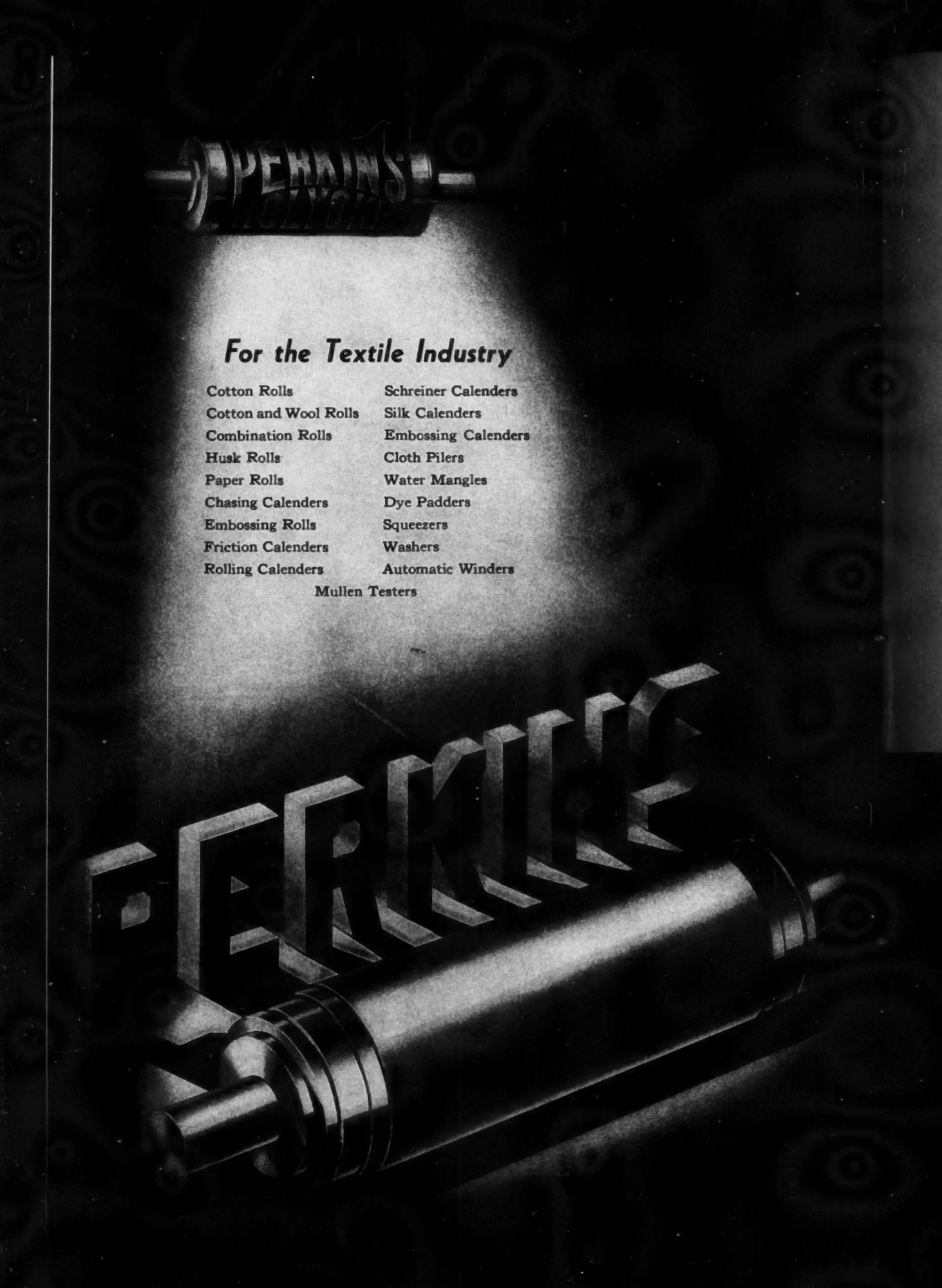
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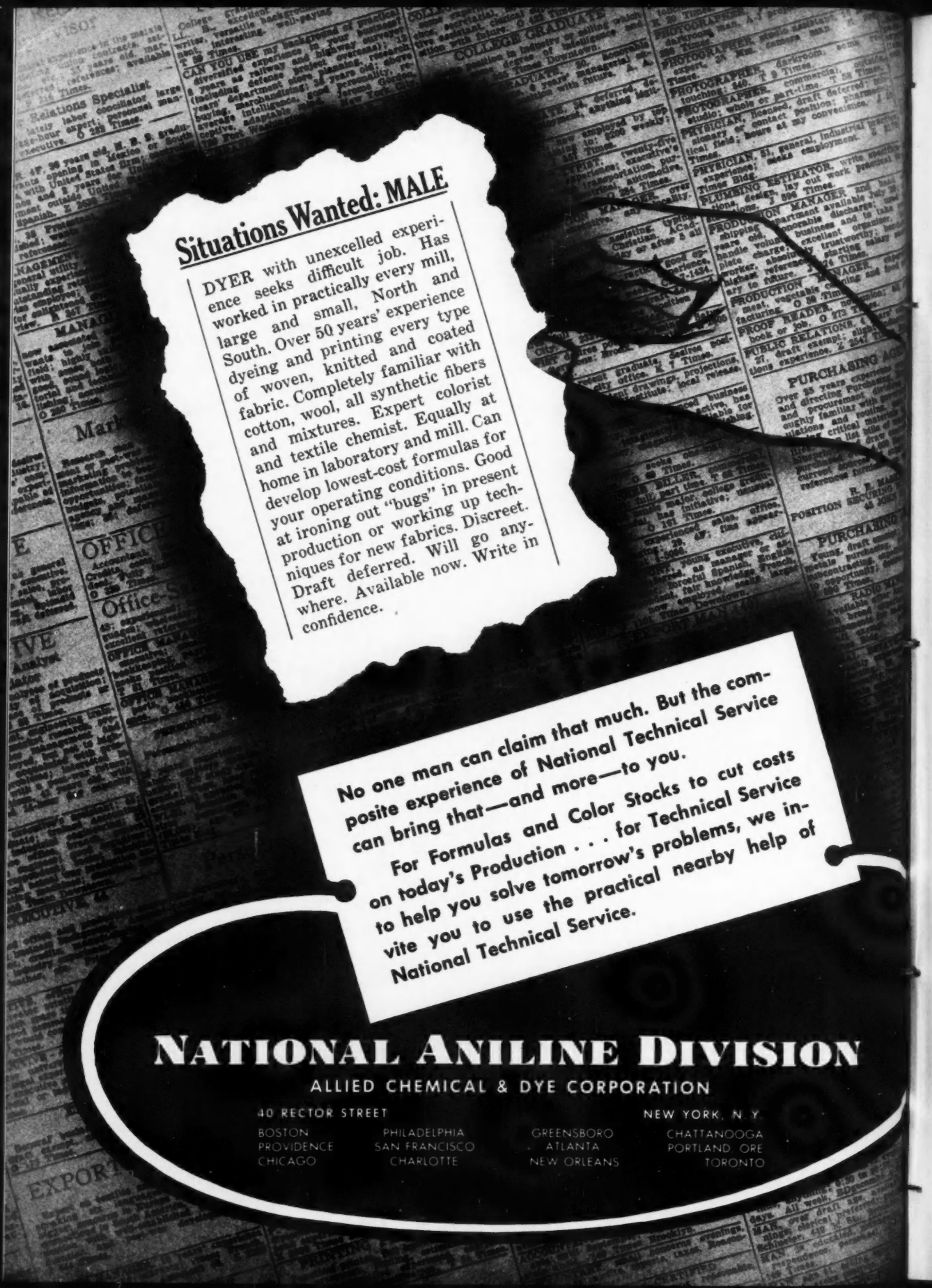
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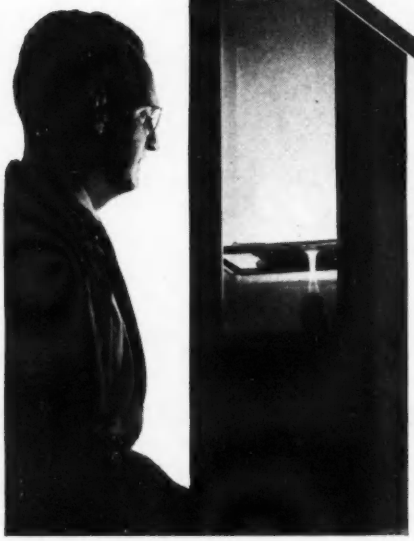

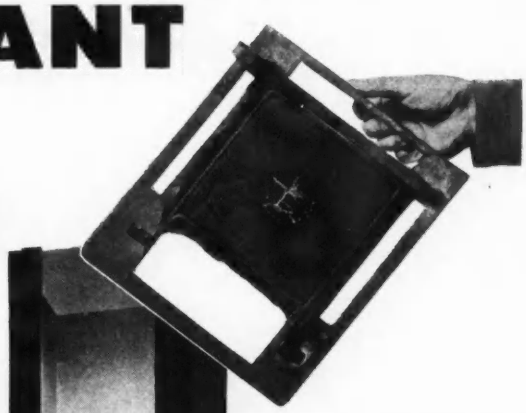

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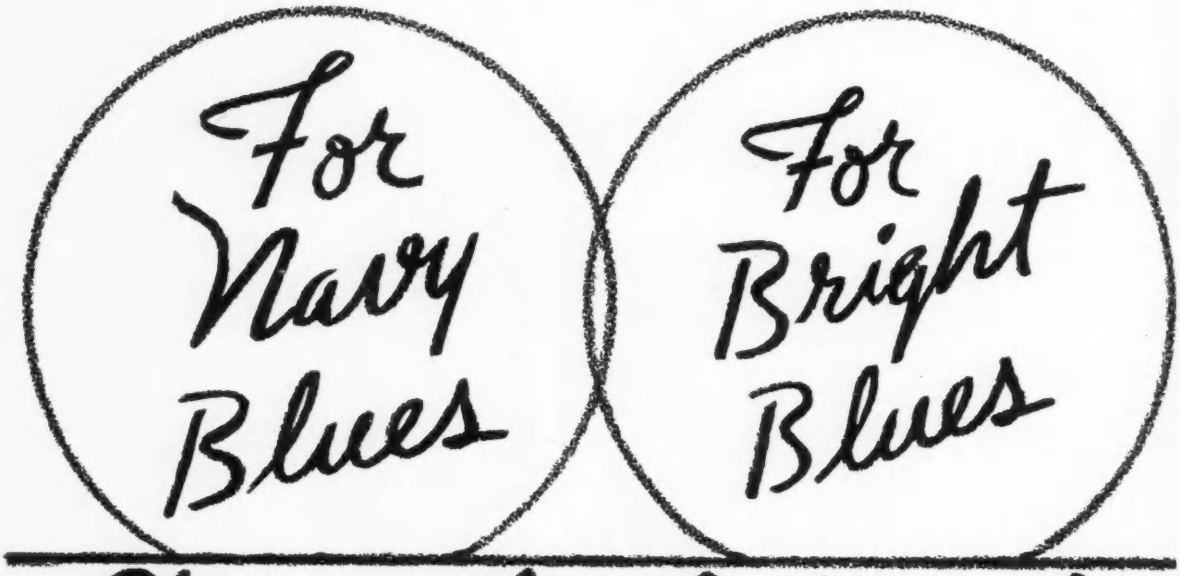

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VOLUME 32 AUGUST 30, 1943 NUMBER 18

FIRE RESISTANT DUCK

JAMES R. REDMOND
Technologist, Textiles
Engineering Division, Jeffersonville Q. M. Depot

FIRE resistant cotton duck is the largest single item on the procurement list of the Jeffersonville Quartermaster Depot and as such it represents one of the most highly developed fabrics of military significance being employed in this war of so many impacts. This paper will discuss the chlorinated paraffin mechanism of the fire resistant finish and will set forth certain data which may be useful in further studies of materials which accelerate the decomposition of chlorinated paraffins, but first it is considered advisable to recount a few of the high spots in the history of the fire resistant finish.

The possibilities of using this fabric in tentage, paulins and covers of many types were recognized by the textile flameproofing industry and brought to the attention of a group of technical men in the Corps of Engineers and the Quartermaster Corps whose minds had been trained to intelligently select those ideas which are as sound as they are aggressive. The cost of the fire resistant process on tentage duck was calculated to represent an increase of approximately 6c per linear yard over the old chrome and iron, water repellent, khaki finish which was standard for heavy tentage until July of 1941, the month in which the first Jeffersonville procurement of fire resistant duck was effected.

From July 1941 to December 1942 procurements were made under Federal Specification CCC-D-746 which is primarily a performance type specification. The inadequacy of this specification became increasingly evident as many of the components of the compounds in use became unavailable or extremely short and the finishers sought to introduce substitutes, many of which had never been previously used in this type of compound. The competition in this work was very keen by late 1942 and in an effort to obtain awards some newcomers in the industry attempted to introduce the cheapest raw materials on the market. If this uncontrolled condition had been allowed to exist, the quality of finishes would soon have been levelled to the pioneer days of fireproofing textiles which are best described by a remark attributed to one of the country's most experienced flameproofers to the effect that one of the first formulas he ever used required the addition of a specific amount of "Road Dust" to the compound. Unfortunately some finishes of this type would pass the preliminary requirements of the "746" specification, but manufacturing difficulties could be expected in the tent manufacturers' shops, particularly abrasive action on sewing machine needles, and the durability of the finished tent under outdoor exposure conditions would be sacrificed.

Since procurements could not be delayed pending completion of lengthy outdoor exposure tests on these questionable finishes, it was decided that a new specification should be written with the inclusion of specific raw material restrictions in addition to performance requirements. This specification would also require each finisher to register his quantitative formula in the confidential file in Jeffersonville. The accomplishment of this specification was made possible through the cooperation of the flameproofers who supplied secret formula information which was correlated with the outdoor exposure data already accumulated by Jeffersonville and the industry. Consequently, on December 2, 1942, Tentative Specification J.Q.D. No. 242 was issued for the fourfold purpose of:

1. Assuring the War Department that only those fire resistant finishes of established durability would be procured.

2. Eliminating abrasive materials likely to cause ruinous wear on critical machinery in tent shops.

3. Affording the Quartermaster Corps with the means for accurately calculating the raw material needs for this huge program and thus aid the War Production Board in utilizing critical materials most efficiently.

4. Encouraging research designed to improve the finish and develop satisfactory substitutes for the critical materials involved.

The specification states that the finished fabric is required to be of one type and one grade, which simply means that irrespective of the nature of the grey fabric being processed, the finished goods must be fire, water, weather and mildew resistant within all the limits estab-

lished by the specification. Basic data on chemical components indicated the desirability of requiring the mandatory use of Chlorinated Paraffin, Antimony Oxide, Calcium Carbonate, a mildew inhibitor, color pigments and a film forming resin of established merit. The progress which has been made since the publication of this specification more than justifies its promulgation and makes possible the publication of the information on chlorinated paraffins which now follows.

The principal function of chlorinated paraffin in fire resistant finishes of this type is to release gaseous products containing chlorine at ignition temperatures which in turn effectually smother the flame. It has been suggested that a supporting reaction takes place between calcium carbonate and the decomposition products of the chlorinated paraffin, resulting in the release of carbon dioxide which acts as an additional flame retardant. The chlorinated paraffins proposed for this finish contained anywhere from 40% to 60% chlorine, but tentative tests including measurement of HCl evolution, indicated that maximum stability and maximum compatibility with the other requirementss of the specification could be expected in paraffins containing between 42% to 45% chlorine. The present stability test was put into use only after a comprehensive study of the rate of evolution of HCl under varying conditions of time and temperature. Briefly, the test consists of maintaining 20 grams, ± 0.1 gram, of chlorinated paraffin at 175° C. in a 22 mm. x 175 mm. test tube through which air is bubbled at a rate of .01 cubic feet per minute for four hours. The air current is directed from the tube of chlorinated paraffin to two Milligan absorbing bottles containing a measured quantity of standard NaOH plus phenolphthalein. After the four hour period the contents of the absorbers are washed into a beaker and the excess NaOH titrated with standard HCl solution to the disappearance of the pink color.

Some laboratories modify this determination of HCl by eliminating the NaOH system and substituting an absorption tube of Ascarite. The HCl bearing air current is passed through an Ascarite tube of known weight and at the conclusion of the four hour test period the Ascarite tube is reweighed and the increase in weight is calculated to percent HCl based on the weight of the chlorinated paraffin. This latter method consumes less time but involves considerable modification of apparatus when the determination is run at temperatures as high as 175° C., for it has been found that at this temperature organic vapors condense in the Ascarite tube and invalidate the gravimetric comparison even though $CaCl_2$ and Anhydrone tubes are introduced between the paraffin and the Ascarite units. The method is quite satisfactory for tests run at lower temperatures, however.

In the cases of paraffin containing 42%-45% chlorine, the amount of HCl evolved in 4 hours at 175° C. ranges from 1.11%-1.75% for unstabilized chlorinated paraffins and from 0.79%-1.14% for stabilized chlorinated paraffins. In this paper the term unstabilized chlorinated paraffin signifies the chlorinated paraffin of regular production and the term stabilized chlorinated paraffin signifies the chlorinated paraffin of regular production plus a stabilizing chemical. It has been found that iron exerts a dechlorinating action on chlorinated paraffin and promotes the formation of hydrochloric acid which in turn catalytically accelerates the decomposition of the chlorinated hydrocarbon. Thus, in the manufacture of chlorinated paraffin great care must be observed to avoid the use of iron and to remove all HCl from the finished product, otherwise, progressive decomposition will take place under normal circumstances. Removal of HCl which appears as a by-product is effected by blowing air or CO_2 through the molten chlorinated paraffin. To further combat these factors of iron reactivity and latent acidity which are such imposing hurdles in storage and shipping problems, most chlorinated paraffin manufacturers add a stabilizing material, usually basic in nature. Laboratory control tests are conducted on both the unstabilized and the stabilized chlorinated paraffins.

A study has been made of the effect of certain additives on the stability of chlorinated paraffins at 175° C. and the following general tendencies may be stated concerning the unstabilized and stabilized samples tested in this program:

A. At 175° C. certain substances greatly accelerate the decomposition of chlorinated paraffin, this decomposition usually being accompanied by foaming and charring. Such materials are:

Iron Oxides
Zinc Oxide
Zinc Carbonate
Zinc Borate

At 175° C. Antimony Oxide is unique in that it forms a volatile compound, Antimony Chloride. This volatile material is carried over into the absorption system where it reacts with water to form an insoluble compound, Antimony Oxychloride. This invalidates the results obtained with Antimony Oxide, but it is possible that the effect of Antimony Oxide on the stability of Chlorinated Paraffin is somewhere between that of the Iron Oxide group and the Calcium Carbonate group below.

B. At 175° C. certain other substances have no effect or cause only a relatively slight increase in the decomposition of the chlorinated paraffin. Such materials are:

Calcium Carbonate
Sodium Carbonate
Lead Chromate
Magnesium Oxide
Magnesium Carbonate
Copper Oxide
Copper Oleate
Carbon Black
Phthalocyanine Blue

C. At 175° C. a number of materials exert a retardant effect on the decomposition. Such materials are:

Magnesium Carbonate (Basic)
White Lead Carbonate

Litharge
Potassium Nitrate
Aluminum Stearate
Barium Phthalimide
Lead Linoleate
Dicyandiamide
Lecithin
Amines

It is interesting to note that if some of the materials listed under Sections B and C are added to the materials listed under Section A during the 4 hour stability test the dechlorinating velocity of the Section A materials as indicated by HCl evolution is considerably reduced.

It is evident that the studies set forth above have concerned first the effect of heat and air on the stability of chlorinated paraffin followed by a study of the effect of certain additives. Many sources have claimed that no significance should be attached to these data because the temperature of 175° C. is far beyond the temperatures the chlorinated paraffin would be expected to encounter as a component of the fire resistant finish on tentage. It is further stated that the catalytic decomposing effect of the Section A materials when used individually with chlorinated paraffin at 175° C. might be negligible under the conditions in which they appear in the final compound. Both of these criticisms are worthy of consideration because there is a lack of correlatable refuting data and it is highly desirable that further study be devoted to the behavior of these additives at lower temperatures, for a series of critical temperatures might be established.

In logical sequence it follows that in order to promote the stability of the fire resistant finish a minimum of chlorinated paraffin and Section A materials should be used to meet the performance requirements of the specification and the stabilizing effect of Section B and Section C materials should be stressed. Examination of Specification J.Q.D. No. 242 reveals that allowance is made for the application of this principle, for, of the Section A materials we find Antimony Oxide and Iron Oxide listed as acceptable, and of the Section B and Section C materials we find Calcium Carbonate, Lead Chromate, Carbon Black, Magnesium Carbonate, Aluminum Stearate, Copper Oleate and Phthalocyanine Blue listed as acceptable. It is generally recognized that chlorinated paraffin is catalytically decomposed under the influence of light, particularly ultraviolet light. Additional work is being done to systematically evaluate the effect of light and moisture and the effect, at lower temperatures, of various combinations of all the materials used in the fire resistant finishes.

At this point it is stated that there is a very definite distinction between a stable fire resistant finish and an unstable fire resistant finish. The progress of deterioration due to unstable finish may easily be traced by periodic tensile strength determinations on the fire resistant fabric being exposed to the elements. In many cases the formation of acid increases with deterioration and pH determinations may be readily correlated with losses in tensile strength. It is evident that the use of an unstable chlorinated hydrocarbon, whether it be unstable due to improper selection of crudes, poor control during manufacturing or the presence of catalytic dechlorinating substances in the fire resistant finish, introduces a source of acid which may attack the cellulose fiber and result in its eventual destruction.

In the search for more representative test methods interesting possibilities have been found in a modified stability test which consists of shredding a 2 inch square of fire resistant fabric into the test tube containing the usual amount of unstabilized chlorinated paraffin. This sample is then run for 4 hours at 110° C. and the release of HCl measured as previously described. The desirable features of a lower testing temperature and utilization of the fire resistant finished fabric itself in the determination of paraffin stability are thus accomplished.

It was found that some fire resistant fabrics caused a pronounced acceleration of the decomposition of chlorinated paraffins at 110° C. Tests were performed on seven chemically different fire resistant finishes of actual commercial production and a comparison was made between four unstabilized chlorinated paraffins of different origin in each case, but containing from 42 per cent to 45 per cent chlorine in every case. Results are given in Table I.

TABLE I

Per cent HCl Evolved in 4 Hours at 110° C.

	Chl. Par. No. 1	*Chl. Par. No. 2*	*Chl. Par. No. 3*	*Chl. Par. No. 4*
Finish A	.12	1.93	2.39	1.21
Finish B	1.29	2.01	2.93	2.07
Finish C	.09	1.83	2.28	1.27
Finish D	.07	.14	.06	.08
Finish E	.06	.70	1.79	.15
Finish F	.08	.73	1.77	.07
Finish G	.07	.15	.05	.10
Grey Goods	.07	.08	.06	.09
Chlorinated Paraffin Control	.04	.21	Not run	.09

The outstanding conclusion to be drawn from this series of tests is the fact that we have established a marked difference between these fire resistant finishes in their catalytic effect on these chlorinated paraffins at 110° C. It is evident from Table I that Finish B exerts the strongest catalytic decomposing action on all the chlorinated paraffins examined, followed by Finish C and Finish A which may be considered equally catalytic. The wide disagreements in the data on Finish E and Finish F indicate the possibility of variation within the finish itself or variation between the paraffins. Finish D, Finish G and the grey goods exerted no decomposng action on the chlorinated paraffins tested. If these differences c an be projected to parallel differences in outdoor durability, then this test assumes particular significance. Outdoor durability is evaluated by determining retention of tensile strength, flame resistance, char resistance, resistance to water leakage, mildew resistance, color and flexibility during outdoor exposure.

The outdoor durability tests on record at the Jeffersonville Quartermaster Depot reveal that Finish B and Finish C are the poorest in the above group. Unfortunately, Finish A represents a relatively new formula and hence there is not sufficient outdoor exposure data on hand to correlate with the apparent decomposing action indicated above. Finish E is superior to Finishes B and C in durability, but it is not equal to Finishes D. F and G, which are the most durable in the above group.

An additional inference to be drawn from the data in Table I is the superior stability of Chlorinated Paraffin No. 1 in comparison with the other three paraffins. When these chlorinated paraffins were compared, using the conventional stability test at 175° C. for 4 hours, no significant differences were recorded.

In a commercial research organization the next step in the development of the above data would be the accumulation of new exposure data on Finishes A, B and C compounded in one case with Chlorinated Paraffin No. 1 and in the other case with Chlorinated Paraffin No. 3, the latter appearing to be the least stable under the conditions of Table I. Jeffersonville's aim has been to eliminate as quickly as possible those finishes which did not satisfactorily resist outdoor exposure and to concentrate research energies on the improvement of the most desirable finishes. In accordance with this policy, Finishes B and C have been completely eliminated and it will be impossible, in view of the limited Jeffersonville personnel which is already charged with a heavy research program, to conduct the study of these finishes as described even though it is of absorbing interest. However, further systematic investigation of the chlorinated hydrocarbon phase of the fire resistant textile system is proceeding at Jeffersonville and in other research laboratories throughout the country and it is expected that more impetus will be given periodically to the quest for the most satisfactory and most durable fire, water, weather and mildew resistant finish for cotton duck.

CONCLUSION

In conclusion this work has shown that certain materials, which may be used in fire resistant finishes covered by Tentative Specification J.Q.D. No. 242, exert a decomposing effect on certain chlorinated paraffins at 175° C., but the velocity of decomposition as indicated by HCl evolution may be considerably retarded by addition of other materials also covered by Tentative Specification J.Q.D. No. 242. The possibility of distinguishing between stable and unstable fire resistant finishes, of the type considered, by conducting stability tests on unstabilized chlorinated paraffin to which a sample of the fire resistant fabric has been added was discussed.

ACKNOWLEDGMENT

The author wishes to thank R. D. Newlin, Jeffersonville Engineering Division, and the research organizations of Halowax Products Division Union Carbide and Carbon Corporation, Hercules Powder Company, Hilton-Davis Chemical Company, Hooker Electro-chemical Company, H. Kohnstamm & Co., Inc., Goodyear Tire & Rubber Company, Philadelphia Textile Finishers, Inc., Interchemical Corporation, American Waterproofing Company and Diamond Alkali Company for their able assistance in this work.

LITERATURE CITED

1. Tentative Specification J.Q.D. No. 242 dated December, 1942.
2. Federal Specification CCC-D-746 dated February, 1939.
3. Wm. T. Bishop, U. S. Patent 2,119,149 (1938).

IT IS UNLAWFUL FOR YOU TO REPAIR PATENTED MACHINERY

W. F. SCHAPHORST, M.E.

ACCORDING to law, you as an owner of machinery have no legal right to make repairs on the portions of such machines that are patented. Perhaps you *have* paid in full for the machinery. Perhaps it *is* legally yours. But that makes no difference in the eyes of the law when it comes to repairing or replacing the *patented* parts. You may break or completely destroy the patented parts if you feel like doing that. Ownership permits destruction but it does *not* permit *building up* of machine parts that are protected by law.

Patents often apply only to a few specific parts. You may do whatever you wish to the unpatented parts, of course. But the patented portions must not be repaired by you or by anybody else without the permission of the patentee. Anybody furnishing parts for patented portions or repairing those parts who is not licensed by the patentee to do so is subject to damages for infringement.

HOW TO SAVE RUBBER

W. F. SCHAPHORST, M.E.

RUBBER has been and still is commonly used as a gasket material, but now that it is becoming so scarce the writer suggests that gasket users begin looking for suitable substitutes.

There are of course places where rubber cannot be supplanted easily. But for large pipe flanges, manholes, tube caps, and the like, there are gaskets on the market that the writer regards as *better* than rubber. Thus for example, thick flexible metallic gaskets are excellent for withstanding high pressures. They are exceptionally strong and considerably thicker than the ordinary rubber gasket. As a result of this thickness they will take care of flanges that are slightly irregular more effectively than will thin rubber gaskets.

Also, metallic gaskets are more easily and economically replaced than are rubber gaskets that "stick." The writer has in mind a job where the time required to replace rubber gaskets was four times as great as the time required to replace thick metallic gaskets. Why? Because the metal gaskets didn't stick at all whereas the rubber gaskets stuck and were removed with great difficulty. Further, due to their thickness and strength the metallic gaskets did a much better job of sealing the joints than did the rubber.

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AUGUST 30, 1943

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Report of Committee on

ACCELERATED AGEING TESTS

for Sulfur-dyed Materials

T. R. SMITH, Chairman

SINCE publication of the report in the 1942 Year Book, the Committee has held three meetings, two at the Philadelphia Quartermaster Depot on October 9, 1942 and April 15, 1943 respectively, and one in Winston Salem, N. C. on June 5, 1943.

At the October 1942 meeting it was decided that accelerated ageing tests be made on five commercially dyed samples obtained from various sources. The samples tested were as follows:

		pH of Goods Before Ageing
Sample No. 1	Sulfur Dyed O.D. shade Barracks Bag Denim, warp dyed on long chain, filling dyed raw stock	7.8
Sample No. 2.	Piece dyed Sulfur Tan Jeans	8.1
Sample No. 3.	Jig dyed Sulfur Brown Sheeting	6.5
Sample No. 4.	Piece dyed Sulfur Khaki Twill	8.5
Sample No. 5.	Piece dyed Sulfur Tan Twill	8.6

The accelerated ageings were carried out as follows by 6 members of the Committee:

C. A. Seibert—Electric Oven 135°C. 6 hours total.
D. P. Knowland—Electric Oven 275°F. 6 hours total.
R. H. Souther—Autoclave 7 lb. steam pressure 220°F. 24 hours.
J. L. Crist—Electric Oven 130°C. 7 hours total.
J. R. Bonnar—Electric Oven 135°C. 7 hours total.
M. H. Klein—Fade-Ometer 120°F. 100 hours.

Breaking strength tests were made by the United States Testing Company on both warp and filling of the six different samples and the results obtained from an average of five breaks are shown in Table 1.

At the April 15, 1943 meeting of the Committee it was decided that statistical evaluation of test results using the T & F tests be used as a means of evaluation. Table 2 shows the result in change in strength after accelerating ageing samples using this method.

TABLE 1

Change in Strength After Accelerated Ageing Samples

Sample No.	*Untreated Standard*	*Seibert du Pont*	*Knowland Geigy*	*Souther Proximity*	*Crist Southern Dyestuff*	*Bonnar General Dyestuff*	*Klein Sandoz Chemical Works*
	lbs.	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
No. 1 Warp	172.6	13.85—	6.84—	10.66—	8.17—	6.84—	13.56—
Filling	90.2	3.33+	4.43+	11.53+	3.33—	5.32+	1.77—
No. 2 Warp	101.6	7.28—	7.28—	10.83—	3.94—	5.51—	.98—
Filling	63.0	18.41—	17.78—	18.41—	.63—	12.38—	7.94—
No. 3 Warp	50.4	35.32—	31.35—	42.86—	32.14—	29.76—	9.92—
Filling	30.0	46.67—	40.00—	34.00—	33.33—	35.33—	15.33—
No. 4 Warp	172.4	12.76—	9.63—	7.60—	11.83—	11.02—	13.57—
Filling	65.2	3.99+	8.90—	3.07—	8.59+	4.91—	8.28—
No. 5 Warp	137.0	2.19—	4.38—	4.38—	1.61+	3.21+	4.09—
Filling	124.8	8.65—	12.02—	8.49—	1.12—	5.13—	7.21—

\+ Indicates gain in strength
— Indicates loss in strength

TABLE 2

Sample No.	*Seibert du Pont*	*Knowland Geigy*	*Souther Proximity*	*Crist Southern Dyestuff*	*Bonnar General Dyestuff*	*Klein Sandoz Chemical Works*	*pH*
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	
No. 1 Warp	14	7	11	8	7	14	7.8
No. 2 Warp	1	7	11	0	1	0	8.1
No. 3 Warp	35	31	43	32	30	0	6.5
No. 4 Warp	13	10	8	12	11	14	8.5
No. 5 Warp	0	1	0	0	0	0	8.6

At the April meeting the chairman was instructed to appoint a committee to standardize the specifications and methods of tests for the oven accelerated ageing tests. This committee reported to the June meeting in Winston Salem. This report was accepted as a report only by the committee at that time. The report is as follows:

Standardized Procedure for Conducting Accelerated Ageing Tests in an Oven on Fabrics Which Have Been Previously Dyed with Sulfur Colors

GENERAL DISCUSSION

As a result of much research work conducted by independent investigators under varying conditions, it has been established that a heated oven is perhaps the most generally accepted and most satisfactory apparatus for conducting accelerated ageing tests on sulfur dyed fabrics. While there have been minor variations in results, as reported by the various investigators, yet the outstanding facts are:

A—Cotton goods which had been properly dyed with sulfur colors and properly finished when subjected to an oven accelerated ageing test gave acceptable results in all instances.

B—Cotton Goods which had been improperly dyed with sulfur colors, and finished, when subjected to an oven accelerated ageing test were detected as being unsatisfactory in all instances, regardless of minor differences of construction and technique of procedure.

It is universally agreed that an acceptable standard procedure for conducting accelerated ageing tests of fabrics should embody the following factors:

1—Such a standard procedure should yield results paralleling those encountered in average storage conditions to which the fabrics may be subjected.

2—Such a standard procedure must be one which can be reproduced at will within a fair range of accuracy.

3—Such a standard procedure should exhibit a progressive deterioration proportionally to temperature, time and humidification.

4—The apparatus selected should be of a type and construction which is readily available to the industry, and of a size in which a sufficient number of samples may be tested at one time. Furthermore the apparatus should be one which can be operated by technicians available in the textile industry.

5—Such a standard procedure should be one which can be conducted in the shortest possible period of time to yield the above described results.

DESCRIPTION OF OVEN

SIZE, DESIGN AND CONSTRUCTION—The oven used may be of any conventional design and constructed of conventional materials as long as the heating elements or materials of construction themselves do not give off gases when heated, which would tend to distort the results. The quantity of materials tested must bear a fixed relationship to the capacity of the oven. 25 Grams of materials tested per cubic foot of oven capacity is considered correct.

TEMPERATURE CONTROL—The temperature control must be accurate within 2° C., plus or minus. Care must be exercised to insure that the thermometer indicates the true and correct internal temperature of the area in which the samples are being tested or fixed.

ATMOSPHERIC CONTROL—The oven should be equipped with ports or vents of such size to allow the air in the oven to be changed approximately each two minutes except when humidifying. This may be accomplished by natural convection or by a circulating system. During humidification the ports or vents should be closed to confine the moisture within the oven for the specified time.

HUMIDITY CONTROL—Controlled amounts of water (or steam) should be admitted into the oven at specified intervals. This may be entered through either the top or the side of the oven. The requisite amount or water should be added onto a heated mass of materials in order to effect rapid vaporization. To effect this relative rapid vaporization the weight of material should be approximately 100 grams for each gram of water admitted each hour. The amount of water admitted should be sufficient to cause the filling of the oven with steam at atmospheric pressure each hour. 20 cc. of water produces approximately 1 cubic foot of vapor at atmospheric pressures and at 135° C. (275° F.) in addition to the desired rapid vaporization of the water admitted, the mass of metal or other materials acts as a temperature stabilizer and serves to prevent a sudden drop in temperature owing to the latent heat of vaporization of the water introduced.

ARRANGEMENT FOR HOLDING SAMPLES—Provision must be made for holding samples to be tested so that they will not come in contact with the hot metal portion of the oven. A suitable means is to hang the materials tested by strings from glass or wooden rods in a manner to assure their not coming in contact with each other or with the sides of the oven. Materials tested must be held in that part of the oven where the temperature is constant and uniform and where all portions of tested samples are exposed to the same temperature and the same conditions of humidity and atmospheric change.

ACCELERATED AGEING TEST

1—The accelerated ageing test shall consist of heating, in the type of oven described above, for 6 hours continuously at 135°C. (275°F.) at the beginning of the second, third, fourth, fifth and sixth hours the ports or vents in the top of the oven shall be closed and 20 cc. of water added for each cubic foot of oven capacity. (If hot water—180° F—is used, there will of course be less temperature shock to the oven). After the water is added, the top ports or vents are kept closed for a

period of five minutes, after which the ports or vents are opened and circulation resumed for the remainder of this hourly period.

2—At the end of the six consecutive hours of heating, the samples tested are removed from the oven and are hung in a room in which the atmosphere is controlled as to humidity and, if possible, temperature, for a period of twelve hours. After this conditioning, the samples are subjected to a breaking, or other test, to determine the degree of degradation of the cotton.

3—In conducting all accelerated ageing tests, samples of acceptable standard goods and of undyed goods—whenever available—should be run along with samples under investigation. In evaluating the degree of degradation, unheated samples should also be tested, along with those which have been subjected to the accelerated ageing test.

The above report submitted by sub-committee composed of—

John L. Crist
Fredrick T. Simon
M. H. Klein

At the April meeting it was also voted that a subcommittee be appointed to investigate the possibilities of the use of the autoclave for ageing. The following report was submitted:

Tentative Procedure for Conducting Accelerated Ageing Tests on Sulfur Dyed Fabrics by Steaming in an Autoclave

GENERAL CONSIDERATIONS

Although it is generally conceded that the oven is perhaps the most satisfactory apparatus for conducting accelerated ageing tests on sulfur dyed fabrics, the results of the cooperative experimental research by the Subcommittee on the Autoclave indicate that the possibility of formulating an accelerated ageing test based on steaming with pressure merits further investigation—either as a replacement for, or an addition to, hot air ageing.

Steam has been long been used in practical accelerated ageing, particularly in the field of textile printing, whereby colorings are obtained by a few minutes exposure in the "agar" which formerly required days and weeks to develop by weathering. Although the literature reveals relatively little on the subject of accelerated testing by steam, one standard method in general use determines whether cotton is overbleached or underbleached by its discoloration after an exposure of one hour at fifteen pounds pressure in an autoclave.

It is assumed that a standard process for the autoclave should embody the same factors as those for the oven. The method adopted, therefore, will most efficiently and accurately fulfill any condition of those factors; such as imitating and correlating actual storage, reproducing the results of tests, exhibiting progressive deterioration, and requiring minimum experimental time with available apparatus.

An important and most favorable feature of the autoclave is that it may function in testing, regardless of size and shape, provided proper controls of time, temperature and pressure, with minimum flow of steam, are maintained. Variables such as atmospheric and humidity conditions are practically eliminated. Consequently, no effort has been made to standardize the apparatus at this time.

DESCRIPTION OF AUTOCLAVE

A typical autoclave, which may be shop built, consists essentially of a closed cast iron cylinder, 23″ long by 15″ diameter, inside measurement, one end of which is a swinging door. A groove in the face of the cylinder holds a square rubber gasket packing, against which the door may be fastened tight by means of an eccentric door clamp lever. The apparatus is mounted on a stand of four legs and is equipped with pressure gauge, automatic temperature recorder, steam inlet with handcock flow control valve, petcock, trap, and baffle of thin stainless steel sheet metal in the top half to prevent drips. A wooden frame, 22″ x 14″, covered with coarse cloth and supported by protruding bolts in the sides along the center, serves as a bottom baffle to prevent possible splashes.

The test swatches or strips may be suspended while ageing, but a better plan is to tack them on frames, which are then placed in the autoclave, pyramid style, with the bottom baffle frame functioning as a support.

TESTING PROCEDURE

Strips about 36″ long and raveled down to 1⅛″ width are cut in half, and one half of the strip is fastened on a wooden frame with thumbtacks, then placed in the autoclave, and steamed according to desired time and pressure. The other half, or unaged strip, is used as a control sample.

After ageing, the test samples, along with any untreated control cloth, are conditioned for at least 16 hours, at standard atmospheric conditions of 65 plus or minus 2% relative humidity, and 70 plus or minus 2°F. temperature.

Breaking tests are made on a standard Scott pendulum type tensile strength machine. The method of testing breaking strength and sampling, as recommended by the Philadelphia Quartermaster's Depot in "The Sulfur Dye Question", are followed as closely as possible, whereby a 1½″ strip, no closer than 8″ from either selvage, is raveled down to slightly more than 1″, so that when placed in the machine, one warp thread is visible to the left of the 1″ x 1″ front jaws, spaced 1″ apart. The breaks shall be clean, and bad breaks discarded.

TEST SAMPLES

The cloth used in tests made by the Sub-Committee was 40″—42 x 34—160 sheeting. Both white and dyed were given the same preparation, consisting of malting,

TABLE 3
Experimental Data
(Autoclave Ageing)

Undyed or White Cloth	*Seibert*			*Souther*		
	Pressure	*Time*	*Strength Change*	*Pressure*	*Time*	*Strength Change*
Test No.	*(Lbs.)*	*Hrs.*	*(%)*	*(Lbs.)*	*Hrs.*	*(%)*
1-W	7	24	0	7	24	0
2-W (Repeat 1-W)	7	24	2—			
3-W				7	21	1.3+
4-W (Repeat 3-W)				7	21	4. +
5-W	15	16	0			
6-W (Repeat 5-W)	15	16	2+			
7-W Oven 135°C. (Seibert)		6	0			
8-W Oven 135°C. (Bonnar)		6	1—			
Dyed Cloth						
Test No.						
1-D				7	1	2—
2-D				7	4	12.5—
3-D				7	6	36—
4-D				7	8	47—
5-D				7	16	53—
6-D	7	20	52—			
7-D				7	21	53—
8-D (Repeat 7-D)				7	21	54.4—
9-D (Second Repeat 7-D)				7	21	54.7—
10-D	7	24	53.3—			
11-D (Repeat 10-D)	7	24	53.8—			
12-D	15	16	57.4—			
14-D (Repeat 12-D)	15	16	58—			
15-D Oven 135°C. (Seibert)		6	46.6—			
16-D Oven 135°C. (Bonnar)		6	42—			

rinsing, bleaching with .5% sodium perborate, rinsing and drying. The dyeing was done on the jigs, using 9 lbs. of Sulfur Tan and Brown and .04 lbs. of Sulfur Black, for a 50 gal. bath. After rinsing, the goods were given an after treatment of 2 lbs. sodium bichromate, 2 lbs. copper sulfate, and 2 lbs. acetic acid (80%), then rinsed and dried, but not finished in order to get a fabric that would show a high rate of degradation for testing purposes. The pH of the white cloth was 6.9; the dyed, 4.7.

CONCLUSION

The data collected thus far tend to show that—

1. Accelerated ageing of sulfur colors may be achieved by steaming in an autoclave.
2. Repeat tests are fairly accurate and well within the range of experimental error for this type of testing.
3. Degradation accelerates rapidly with time until maximum is reached, when rate drops sharply to minimum.
4. Apparatus is inexpensive and simple in construction and operation.
5. Due to the powerful catalyzing action of moisture, it is thought that steam at approximately 115°C. will accelerate equivalently to hot air at 135°C. This assumption will be further investigated in an effort to establish definite correlation between the oven and the autoclave.

Respectfully submitted by the Sub-committee on the Autoclave

R. H. SOUTHER
J. R. BONNAR
C. A. SEIBERT

Frederick T. Simon of the Philadelphia Quartermaster Depot submitted a report to the June meeting on determination of cuprammonium viscosities as a method for testing degradation of sulfur dyed fabrics on ageing as contrasted to breaking strength determination. Mr. Simon's investigation appeared to question some preconceived and long accepted ideas as to the effect of acids, alkalies and certain methods of after-treatment as they affect the determination upon ageing of sulfur dyed fabrics. Mr. Simon questioned the present methods of testing and the evaluation of results and was of the opinion that the problem was one of fundamental research involving considerable time and investigation. During the discussion of Mr. Simon's work, John L. Crist stated that he would arrange for the determination of cuprammonium viscosities in relation to breaking strength determinations on sulfur-dyed fabrics. O. G. Edwards agreed to send Mr. Simon samples of sulfur-dyed cotton yarn which have been stored for a number of years in order that Mr. Simon may determine their cuprammonium viscosities. Mr. Edwards had previously reported to the Committee on these samples as follows:

REPORT

Date 3/29/43

Subject: Loss in strength of Sulfur-dyed Yarns During Storage History of Samples:

This yarn was dyed in raw stock and spun during June of 1938. These particular samples were selected due to the fact that a complete history was kept, and also yarn of the longest period of storage.

All samples were broken in 120 yard skeins on Scott

TABLE 4

Color	Per Cent Color	Break 1938	Break 1943	Lbs. Loss	Yarn No.	Dyeing Temp.	Type Machine
Light Blue	2.75	201.8	172.8	29.0	10/1	200° F.	Circulating
Navy Blue	13.00	93.4	76.8	16.8	20/1	200° F.	Circulating
Pea Green	6.25	97.0	90.4	6.6	20/1	200° F	Circulating
Light Green	2.75	100.7	100.2	.5	20/1	180° F.	Revolving
Green	10.00	133.0	120.2	12.8	14/1	180° F.	Revolving
Medium Dark Green	15.00	102.8	94.6	8.2	20/1	180° F.	Revolving
Dark Green	15.00	131.8	121.9	9.9	14/1	180° F.	Revolving
Black	11.00	69.6	50.2	19.4	24/1	200° F.	Circulating

vertical machine. The results are shown in Table 4.

Finishing of this raw stock dyed cotton.

All the cotton with exception of the black was washed for one hour in running cold water. A twenty minute wash in water at 120°F. with 5% sodium chloride and 2% of 20% cation active softener. The cotton was dried at speed of five minutes, with the dryer having a temperature at the wet end of 230°F. and 200°F. at the dry end.

The black was washed for forty-five minutes in cold running water, then the water was heated for fifteen minutes to 200° F. The final rinse consisted of twenty minutes at 120° F. with 5 per cent sodium chloride and 1¼ per cent sodium acetate, and dried in the same manner as above.

It was thought that it would be well to compare the above results with some other dyed yarns, say vats. But it was found that no true data was available, such as history of treatment, etc. I submit this trusting that it will throw some light on the work now being done. I am,

Yours truly, O. G. EDWARDS

July 21, 1943.

Cuprammonium Fluidities of old Sulfur Dyed Samples Received from O. G. Edwards of Avondale Mills

1. Reference is had to the original letter of transmittal dated June 7, 1943, from the Avondale Mills wherein all samples of yarn which had been previously tested and reported as of March 29, 1943, with the exception of No. 392B, dark green, were tested. The results of this report are tabulated as follows:

Color	Lot No.	% Color	% Loss in Strength 1938-43	Yarn No.	Dyeing Temperature	Type Machine	Cuprammonium Fluidity rhes
Light Blue	248B	2.75	14.5	10/1	200°F.	circ.	2.7
Navy Blue	2406B	13.0	18.0	20/1	200°F.	circ.	12.1
Pea Green	348B	6.25	7.0	20/1	200°F.	circ.	4.0
Light Green	393B	2.75	0.	20/1	180°F.	revolving	2.6
Green	349B	10.0	9.5	14/1	180°F.	revolving	17.5
Med. Dk. Green	396B	15.0	8.0	20/1	180°F.	revolving	6.3
Dark Green	392B	15.0	7.5	14/1	180°F.	revolving	...
Black	116B	11.0	28.0	24/1	200°F.	circ.	21.9

2. In general, there is direct correlation between loss in breaking strength and fluidity in rhes which has been reiterated time and time again. The black, which is considered the most dangerous criminal of the sulfur dye family, again is pointed out to be quite undesirable since 21.9 rhes is considered a very badly degraded cellulose. The 12.1 and 17.5 rhes for the navy blue and green respectively, can possibly be explained by the fact that sulfur black could very well have been used in the formulation to obtain the shades. The navy blue shade looks as if it could have less sulfur black in its formulation than the green. By and large, there is still a clear cut case against the use of sulfur black; however, five years has not materially affected the strength or state of degradation as determined by cuprammonium fluidity of the four other samples, wherein there is a remote chance that the sulfur black had been used. These are in the range of undegraded cellulose, that is, 1 to 10 rhes.

FREDERICK T. SIMON

Mr. Simon speaking at the June meeting for the representatives of the Philadelphia Quartermaster Depot, with whom the Committee has worked closely, indicated that although a suitable ageing test was agreed upon, this would not of necessity result in the acceptance of sulfur dyed fabrics by Army Procurement Agencies. He further stated that there were other more important obstacles standing in the way of acceptance of sulfur colors by the Army.

Lieut. Col. Frank M. Steadman agreed to submit to the various investigators on the Committee pieces of a standard sulfur dyed fabric on which the Philadelphia Quartermaster Depot has a complete history, in order that all investigators might work on the same fabric processed in the same manner. Col. Steadman also agreed to work upon the matter of a standard for ageing tests and a standrd for testing ovens.

CALENDAR OF COMING EVENTS

Meeting, Southeastern Section, Atlanta Athletic Club, Atlanta, Ga., September 18, 1943.

Intersectional Contest, in conjunction with New York Section Meeting, Downtown Athletic Club, New York City, October 22, 1943.

Council Meeting, New York City, October 22, 1943

SOUTHEASTERN SECTION MEETING

THE Southeastern Section will hold a meeting at the Atlanta Athletic Club, Atlanta, on Saturday, September 18, 1943 at 7:30 p.m.

This meeting will be devoted to another of our Round Table Discussion programs, and as before, we are expecting a large attendance.

LEE L. BAKER, *Secretary*

NEW YORK SECTION COMMITTEES

DUE to the increased membership of the New York Section of the American Association of Textile Chemists and Colorists and to the large attendance at the meetings, it was found desirable to appoint two new committees this season in order to serve more adequately the convenience of the members. One of these committees is the Reception Committee under the chairmanship of Robert E. O'Hara of Joseph Bancroft & Sons Co. Mr. O'Hara is well and favorably known in the New York market and has a wide circle of friends in the textile field.

The other new committee is the Registration Committee under the chairmanship of Paul J. Luck, Calco Chemical Division, American Cyanamid Co. Mr. Luck was chairman of the committee for the last outing conducted by the New York Section and has had considerable experience in arranging for banquets and entertainments for other organizations. Also serving on Mr. Luck's committee are:

Raymond H. Drukker,
Standard Bleachery and Printing Co.
Leonard G. Tubbs,
Arnold, Hoffman & Co.
J. H. Hennessey,
General Dyestuff Corp.

Paul J. Luck

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the American Dyestuff Reporter any vacancies which may occur in their business.

NOTICE TO EMPLOYERS

Personal Histories and Employment Records of the following applicants are on file at the office of the American Dyestuff Reporter. Prospective employers may examine them without obligation.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE AMERICAN DYESTUFF REPORTER AT ONCE.

A-2

Education—Graduate, Lowell Textile Institute, B.T.C., 1933.
Experience—Experienced as textile chemist, chemist-spotter, agricultural chemist and U. S. Army inspector on cotton, rayon, woolens and worsteds. Seeks research or control position with future. New England preferred.
Age 34; married; references.

A-3

Education—B.S. in chemistry, Lehigh University.
Experience—Experimental engineer and analytical chemist, 8 mos.; assistant superintendent of silk corporation, assisted in planning and directing production, in charge of laboratory, technical work, personnel, purchasing, etc., 2 years; inspector of ordnance material, to the present. Seeks position as chemical engineer or chemist.
Age 26; single; references.

A-B-C-F-3

Education—High school and full apprenticeship.
Experience—Practical Dyer and finisher. Long experience on specialties for men's wear trouser trade in cottons, cotton and rayon mixtures and cotton and Celanese. Is disposing of interests in progressive finishing plant and seeks position as manager, assistant manager or technical advisor. Thoroughly understands requirements of Quartermaster, especially on herringbone constructions.

C-1

Experience—Experienced as assistant finisher, finisher and superintendent of finishing since 1923. Experience on automobile cloth, boucle overcoatings, high grade men's wear worsted, low grade woolens, medium grade plaid-back overcoatings, fleece finish overcoatings. Bolivias, kerseys, medium-grade men's piece dye suitings, uniform cloth, flannels, ladies' dress goods and coatings, government serge and elastique fabrics, marine wool, flannel shirtings.
Age 37; married, 3 children; references.

Members in the Armed Forces of the United Nations

Note: This is a supplement to the list that appears in the 1942 Year Book. The Secretary, Box 28, Lowell, Mass., will appreciate additions and corrections.

Adams, Rivers J.
Almond, Peter Henry
Anderson, Jack H.
Andrews, Talcott D.
Anthony, Henry S., Jr.
Bachman, Clarence Wm.
Bartenbach, Wm. S.
Bean, Kenneth W.
Beidler, Henry L.
Bergman, Carl Axel
Berman, Isadore
Billings, Lyman
Black, James W.
Black, Joseph J.
Bogle, Robert C.
Bohannan, Joe T., Jr.
Brandt, George
Brilliant, Ira F.
Buckley, Herman T.
Burnthall, Edward V.
Causey, Hugh Ward
Chace, William G.
Corden, F. W.
Cleveland, Giles P.
Cobb, Columbus Asbury
Cohen, George
Cohen, Gordon S.
Coleman, A. A.
Connorton, John J.
Colby, Vernon W.
Collier, Elmer
Conrad, John E.
Corrigan, William D.
Coulman, Malcolm P.
Davis, Thomas A.
Deegan, James J.
Dempsey, James E.
Ditton, Erb N.
Eddington, Elwood M.
Edwards, Winston A.
Entwistle, William W., Jr.
Farland, Raymond A.
Fernald, Brackett B.
Fitzgerald, John J.
Fogel, David
Frank, Allen M.
Friedrich, Ferdinand L.
Fritz, Robert F.
Fry, Wayne F.
Glenn, James J.
Goodavage, Joseph E.
Goodwin, Andrew W.
Granger, Robert J.
Green, Harry A.
Grundy, Harry G.
Guay, Raymond J.
Haas, Raymond M.
Harley, John A.
Hart, Frank
Hart, Tobe V.
Hawes, Ralph Edson
Heffernan, John V.
Hilger, Frederick E.
Hilton, John, 2nd
Hirn, John E., Jr.
Hirsh, Morris L.
Hodes, Ben J.
Hodges, Harry G., Jr.
Holterhoff, Hans A.
Horney, Robert Lee
Hughes, Wm. A.
Inderfurth, Karl H.
Johnson, John T.
Jones, Jos. E.
Jordan, Herman Jack, Jr.
Jordan, Wm. H.
Kobayashi, Fritz F.
Kopycinski, Jos. V.
Kuzdal, Thos. R.
Lack, Fred S., Jr.
Lane, Walter W.
Larson, Wm. R.
Leak, Robert C.
Lehman, Stephen F., Jr.
Lisien, Walter
Lister, Kenneth A.
Lueck, Edward L.
Malick, Donald
Martin, Paul J.
Massingham, R. G.
Melton, Jos. Glenn
Meyers, Chester W.
Mogilnicki, Gene J.
Monroe, Edmund F.
Moss, Dan
Murphy, H. James
Murphy, John A.
Nebelung, Ralph
O'Dea, Daryl Robert
Orr, James E., Jr.
Osborne, Walter Scott
Patnaude, Earl V.
Peterson, Eric A.
Pettus, Samuel A.
Pharr, Jones Y., Jr.
Pitt, Robert R.
Phillips, Charles R.
Potter, Abner D.
Powel, Samuel, Jr.
Prime, Geo. E.
Quinlan, Francis T.
Redston, Reginald W.
Robertson, Julian
Rhodes, Milton
Rhodes, Q. M.
Rockett, John C.
Rogers, Aubrey W.
Rosman, Harry
Sandner, Charles R.
Schladt, Henry N.
Schlesinger, Morton
Scott, John E., Jr.
Sites, Walter H.
Slaughter, Edwin F.
Smith, Jos.
Smith, Willard E.
Soroka, John G.
Stafford, Richard E.
Stewart, Ernest P.
Stevenson, C. O.
Stribling, Robert S.
Sullivan, Brendan V.
Tanis, Roy L.
Taylor, Evan A., Jr.
Tomalino, John J.
Weintraub, P. L.
Weisz, Warren H.
Welch, Irvin H., Jr.
West, John Taylor
Wheaton, Sidney L.
Whitenight, Harold P.
Wiggin, Russell M.
Wilkinson, Jos. B.
Williams, John D.
Winn, Lelia J.
Withers, Robert S.
Wobecky, Francis B.
Wood, Howard Lee
Wunsch, George G.
Yates, David W.

OBITUARY

ERNEST G. ALBERQUE

ERNEST G. ALBERQUE, active for many years in the dyeing and finishing field, died on August 9th at his home in Ridgefield Park, N. J. He was 68 years old.

Mr. Alberque was born in Buffalo and began work at the age of twelve in the mills of Charavay & Bodvin Silk Co., later becoming a member of the firm. He was instrumental in merging this company with the Silk Finishing Co. of America in which he was also a partner. He retired from business in 1912, at the age of 37, but later organized the Progressive Silk Finishing Co. of Hoboken and became its president. In 1919 he organized the Passaic Piece Dye Works and served as treasurer. He held both these positions at the time of his death.

Mr. Alberque was a founder and director of the Dyers and Printers Industry of America and a member of the Board of Arbitrators of the National Federation of Textiles. He was also an industry representative in Washington for the administration of the Fair Trade Practices Act.

He is survived by his second wife and their four children, two children by his first wife and a brother.

• INSTITUTE OF TEXTILE TECHNOLOGY

A group of 29 cotton mills have organized an Institute of Textile Technology with Ward Delaney, for several years on the staff of the Institute of Paper Chemistry at Appleton, Wisconsin, as executive director.

The institute will engage in fundamental and applied research in the field of cotton textiles and will, in addition, carry on a program of graduate training. Candidates for this training will be selected from scientific and technical schools throughout the country.

The institute will be modeled after the Institute of Paper Chemistry whose methods were fully described in the AMERICAN DYESTUFF REPORTER in an article published February 2nd, 1942. Temporary headquarters of Mr. Delaney are at the Hotel Barclay in New York. Locations of permanent buildings will be selected later. Chemistry, physics, mechanics and electronics will have an important place in research to be carried on.

A sub-committee has been appointed to obtain a charter for the organization and to draw up by-laws. Information obtained by the Institute will be for the confidential use of its members only. Other members of the cotton industry will be invited to join shortly.

• REDUCED PROCUREMENT OF WOOL FABRICS

Procurement of blankets and wool fabrics for Army use will be substantially reduced in 1944, Major-General G. L. Corbin, Director of Procurement, Office of the Quartermaster General, told members of the Woolen and Worsted Manufacturers' Industry Advisory Committee meeting with officials of the War Production Board on August 11th.

At the same time, General Corbin assured the committee that no cancellation of existing contracts is contemplated and that present contracts will be completed unless unforeseen circumstances—such as a sudden termination of hostilities—make a different course advisable.

Arthur D. Whiteside, WPB Vice Chairman for Civilian Requirements, who also spoke to the committee, pointed out that whatever facilities are made available through relaxation of Army procurements will be needed to capacity for the manufacture of essential civilian type goods and goods for Lend-Lease.

General Corbin explained that in the event that contracts are cancelled either partially or in full, the present policy of the War Department is to provide prompt reimbursement to the contractor for any loss which he might face as a result of contract cancellations. It was indicated that where goods to be made under a cancelled contract were in process of being manufactured, the goods would either be completed and purchased by the Government for ultimate disposal through other channels, or the contractor would be reimbursed for any loss suffered as a result of the cancellation.

General Corbin further stated that it is the policy of the War Department to act energetically in making prompt settlement of claims arising out of deferments in deliveries and cancellations of contracts.

In revealing that Army requirements for wool products will be less next year, General Corbin pointed out that stocks on hand plus goods on order are expected to be ample for both original issue clothing and blankets and also for replacement purposes during the first part of 1944. He said that the "pipelines" through which Army material reaches Army fighting forces in various parts of the world have been adequately provided for as far as wool products are concerned and that continued heavy procurements are no longer contemplated.

General Corbin also stated that deliveries of 1944 procurements are expected to be at approximately the same rate as present deferred deliveries and that, therefore, in order to maintain a continuity of the operation of machinery, he expected to place further contracts in February.

Lt. Charles Harding, speaking for the Navy, said that he did not expect any deferments in Navy deliveries during 1943 or in the early part of 1944.

Kenneth W. Marriner, Chief of the Wool Branch, Textile, Clothing and Leather Division, told the Committee that production of wool fabrics and yarns during the first half of this year was slightly greater than during the same period of 1942 in spite of manpower problems.

While this record is commendable, there are, however, a few apparent shortages in certain items, he said. Among these are melton type fabrics which are needed in larger volumes this year because of increased requirements of snow and ski suits for children, and mackinaws and utility or lumberjackets for outdoor workers.

Mr. Whiteside expressed appreciation to the Army for its co-operation in deferring part of its wool contracts in order to increase civilian production. He reminded the Committee that this is the first time that an opportunity has been presented to the industry to devote a substantial part of its facilities to civilian production, and put stress on the fact that the main reason this was done was to assure enough civilian clothing for wear this fall and winter.

• "E" AWARD TO SMITH, DRUM

Smith, Drum & Company, manufacturers of textile dyeing and finishing machines and laundry equipment, were presented with the Army-Navy "E" Award at colorful ceremonies held at the company's plant in Philadelphia on August 10th.

Dr. A. J. Stoddard, Superintendent of Philadelphia Public Schols, acted as master of ceremonies and gave the introductory address in which he sketched the history of Smith, Drum Company from its humble beginning in 1888 to its present day position in its field.

Major Victor Smith, Chief of the Philadelphia Regional Office of the Philadelphia Ordnance District, on behalf of the Undersecretary of War, then made the presentation address. He said in part: "This award, for excellence in production, is not lightly bestowed. Less than 2 per cent of all the firms throughout the country engaged in war work has been honored so far. It carries with it the heartiest congratulations of Robert P. Patterson, Un-

dersecretary of War and James V. Forrestal, Undersecretary of the Navy."

Parker M. Smith, President of the company and son of Robert P. Smith, one of the founders, accepted the Award on behalf of the company. In his brief talk, Mr. Smith paid homage to his father and mother and to George E. Drum who "contributed so much in the early days toward building this business on a solid foundation." Mr. Smith also credited the employees of the company for being largely responsible for receiving this honor and commended their purchase of almost $60,000 worth of War Bonds to date.

Harry S. Drum, Vice-President and General Manager, spoke of the loyalty of the entire organization and their unstinted efforts and co-operation that have been responsible for turning out in 1942 more than four times the normal production of the plant, with a comparatively small increase in manpower.

The presentation of the Army-Navy "E" pins was made by Lt. A. R. Winner, U.S.N.R., of the Office of the Inspector of Naval Material, Philadelphia. At the end of his address, Lt. Winner read the following citation: "For meritorious and distinguished service to the United States in its time of need, the Army-Navy production award is presented to the men and women of Smith, Drum & Company. By their unlagging spirit of patriotism . . . by their acceptance of high responsibility . . . by the skill, industry and devotion they are showing on the production front of the greatest war in history . . . they are making an enduring contribution not only to the preservation of their country but to the immortality of human freedom itself." Receiving token "E" pins as representatives of the company's employees were . . . James Montgomery, Charles Roth, Joseph Dawson, Gustav Schmidt and Diane Kaplan.

Following this, James Montgomery, who has been with Smith, Drum & Company for 44 years spoke on behalf of the employees in accepting the Award.

In addition to employees and their families, many guests prominent in the textile, laundry and allied fields also attended the impressive ceremonies.

In the photograph above are shown, left to right, Dr. A. J. Stoddard, Major Victor Smith, Lt. A. R. Winner, James Montgomery, Harry S. Drum and Parker M. Smith.

● ORDER M-328 AMENDED

Basic controls over distribution of all textile, clothing, leather and related products—as established by Order M-328—were broadened recently by the War Production Board in amending the order. The order as originally issued revamped the entire priority rating structure for textiles and leather and restricted the use of ratings to the most essential purposes.

The recent action extends these controls with three major effects:

1. Addition of four schedules to the order sets up an over-all policy for distribution of rejects, over-runs, by-products, and seconds. Unless otherwise provided in the schedules, these materials may be sold free of the restrictions of Priorities Regulation No. 1, but subject to other provisions of M-328 and any other orders which may be specifically applicable.

2. The basic WPB policy regarding fair distribution of textile, clothing and leather products is incorporated in the order. The clause states in specific terms the objectives and purpose of the policy and provides that WPB may issue specific directives to effect equitable distribution when voluntary observance of the policy is "inadequate."

3. The framework for issuance of specific WPB directives covering production, fabrication, processing, or delivery of textile and leather goods to meet particular military or civilian requirements is written into the order. Actually this is simply a restatement of authority proviously incorporated in provisions of other WPB orders affecting textiles and leather.

A reject is defined in the order as anything made to fill a rated order but rejected by the person ordering it because of "defects, failure to deliver on time, or any other reason." Its distribution is subject to the over-all controls of Order M-328, unless otherwise provided in Schedules B, C, D, or E of the order. In addition, rejected hides, skins, and leather and products made primarily from them may be disposed of according to Order M-310.

The four schedules cover:

1) Rejects which may be delivered only on specific authorization of WPB. At present, these are military luggage and sleeping bags, and silk and nylon yarn, and silk and nylon woven, knitted and braided fabrics. To obtain authorization, manufacturers must make formal application to WPB giving full details of the material, and enclosing a copy of the rejection.

(2) Rejects which may be delivered only for specified end-uses. At present this schedule covers wool yarn, fabrics, and felts, and material containing over 25 per cent wool fiber by weight, plus eight specific types of cotton fabrics. The wool rejects may be used without further authorization for manufacture of clothing, blankets, and for industrial uses. The cotton rejects are permitted for specific end-uses, depending on the type of fabric. For example, 8.5 herringbone twill rejects can be used only for work clothing and foundation garments. Thirty-nine inch 80x80 4.00 yard print cloth rejects are permitted for clothing and foundation garments. Nine ounce sateen rejects can be used exclusively for clothing. Certain types of drills are allowed for mattress or pillow tickings, pocketings, and clothing. All items on this schedule are released for the permitted uses immediately.

(3) Rejects which may be delivered only to fill rated orders.

(4) Rejects which may be delivered to the Army or Navy only.

At present, no items are listed on the last two schedules.

The equitable distribution clause is directed primarily at products which are sold in the open market and whose distribution is not subject to priority controls. "Due regard must be given to essential civilian needs, and there should be no discrimination in the acceptance or filling of orders as between persons who meet the seller's regularly established prices and terms of sale or payment," the policy states. "Under this policy every seller of the items, so far as practicable, should make available an equitable proportion of his merchandise to his customers periodically, without prejudice because of their size, location, or relationship as affiliated outlets. It is not the intention to interfere with established channels and methods of distribution unless necessary to meet war or essential civilian needs. If voluntary observance of the policy outlined is inade-

quate to achieve equitable distribution, the War Production Board may issue specific directions to named concerns. A failure to comply with a specific direction shall be deemed a violation."

Other changes in the amended order are:

1. Ratings specifically permitted by the order for procurement of any item on Schedule A cannot be extended for delivery of any other item on Schedule A which is to be incorporated into the product for which the rating was originally used. For example, a rating permitted for procurement of a fabric cannot be extended for purchasing the yarn going into the fabric. The only exception is military orders, and orders for the Maritime Commission and War Shipping Administration. This provision supersedes provisions of Priorities Regulation No. 3.

2. Ratings assigned by CMP regulations for maintenance and repair purposes are now valid for procurement of brushes and brooms.

3. Ratings for materials used in functioning parts of industrial machinery are validated insofar as specific items on Schedule A are concerned.

● RESEARCH ACTIVITIES CONSOLIDATED

In a move designed to increase the effectiveness and scope of its research work, the American Viscose Corporation is consolidating all its basic research activities at Marcus Hook, Pa., the location of one of its rayon plants and of its principal research facilities, it was announced recently.

Heretofore the company's research work on viscose and acetate rayon has been carried on at Marcus Hook and Meadville, Pa., respectively. Under the new arrangement, research on these two products, together with all other basic research, will be done at Marcus Hook.

Dr. Charles S. Venable, previously in charge of the corporation's viscose chemical research laboratory at Marcus Hook, becomes director of chemical research for the corporation, and F. William Koster, previously in charge of acetate rayon and "Vinyon" research at the company's plant at Meadville, Pa., has been named assistant director of chemical research. It is expected that a number of the research staff that has worked with Mr. Koster at Meadville will be transferred to Marcus Hook.

It is anticipated that greater efficiency and better all-round results can be achieved by bringing together in this way the men who direct the corporation's basic research activities. In addition, the research facilities are to be considerably expanded, not only for increased work on the chemical aspects of rayon production, but also for more intensive experimental work and added pilot plant operations.

● IDENTIFYING CLOTH SQUARES

Brightly colored squares of cloth used to identify Army ground equipment and prevent American planes from attacking their own troops are coated with ethyl cellulose, Hercules Powder Company reports.

These patches of cloth, some of them only a few feet square, can be seen two miles up by fighter planes going at top speed. The Army uses a special ethyl cellulose coating because tests show it will remain fully flexible in winter cold and not get tacky in summer heat. No other type of coating tested measured up to Army requirements. The color will not run, and it is possible to keep the reverse side of the identification cloth panel a pure white color.

Hercules was the first chemical company to manufacture ethyl cellulose in this country and has recently announced plans to double output. Based on either cotton or wood pulp, combined with alcohol, ethyl cellulose is under allocation for use in plastics, textile coatings, and other war needs.

● SAFETY PROGRAM

NED H. DEARBORN
Executive Vice-President, National Safety Council

THEY weren't at work, but 26,500 American workers were killed by accidents during 1942.

They were killed on cellar stairs, in bathrooms, driving cars, crossing streets. They died "accidental" deaths on fishing trips and while swimming. They shot themselves cleaning "unloaded" guns. They drank what they didn't think was poison.

They were killed in almost every conceivable way and in almost every imaginable situation, *except* at their benches and machines.

With absenteeism such a serious production and personnel problem, employers have become acutely aware that there are two kinds of accidents—those suffered on the job and those suffered off the job. Keeping books on time lost from accidents in those two categories measures the problem and indicates where added emphasis is needed.

No split bookkeeping is needed, however, to see the result. Regardless of where an accident strikes a man down, time is lost from work. Hence, the occurrence becomes a very real production, personnel AND safety problem to employers.

I said that off-the-job accidents killed 26,500 workers last year.

Check the following figure and the comparison it makes with that off-the-job total: Accidents ON the job killed 18,500 workers during 1942. Simple arithmetic shows that 8,000 MORE workers were killed in accidents OFF the job than were killed ON the job.

In addition to accident fatalities, 2,200,000 workers suffered non-fatal, time-losing accidents OFF the job, 300,000 more than the total who suffered non-fatal, time-losing accidents ON the job.

Those figures pose a problem to management: What to do about accidents to employees which occur while they are away from work—accidents which are robbing war production of tens of millions of man-hours of victory-hurrying work?

By supervision, rules, regulations, discipline and mechanical guarding the ON the job problem can be controlled. We all know that. But what can an employer say or do about how safely or dangerously an employee conducts himself while he is on his own time?

The approach to the problem has been to expand the educational part of the plant safety program into a 24-hour round-the-clock safety activity, giving emphasis to the vital off-the-job phase of an employee's daily routine.

Thus the psychological effect is that there are not two safety programs, but only one which does not make a sharp distinction between off-the-job and on-the-job periods. It is a blend of the two which permits emphasis to be placed wherever it is most needed at the time.

Some months ago the Council created a special Off-the-Job Safety Committee which is now conducting a nation-wide campaign against accidents to workers while they are away from work—co-operating with individual plants directly and also through local safety councils.

The Committee's first job was, of course, to collect and co-ordinate every scrap of available information and experience about how workers are accident-injured off the job. This has been done. It also was necessary to prepare a campaign for wartime industry—that is, a program designed for simplicity, one which would require industry to establish no new routines.

The resulting program consists of the following: special posters on specific off-the-job subjects for plant bulletin boards, cartoons and feature articles for plant magazine and newspapers, leaflets for distribution or mailing directly to workers, a leaflet containing data and discussion suggestions for plant meetings of safety committees, two sound slidefilms for such meetings, a data sheet on plant parking and safety at loading points.

More than 2,000 plants are now using all or most of these materials to curb their off-the-job accidents. A million leaflets already have been distributed to workers. More than 100,000 posters on the subject are appearing on bulletin boards.

A thousand plant publications are carrying the cartoons and educational articles prepared especially for them.

And, mind you, until a few months ago management of these plants was not much more than dimly aware of the off-the-job problem and how it was affecting production.

Like everyone else, the National Safety Council is in this war up to its neck. It is under a special commission from President Roosevelt to continue a nation-wide Save Manpower for Warpower campaign until peace again comes to the world. The biggest single job we've got is to help you industrial people and other employers with your accident problems and thus increase both production and efficiency, as well as conserve your manpower.

In important ways off-the-job accidents cause more trouble to industry than the on-the-job accidents. We believe we can help you with this "after the whistle blows" portion of your safety problem. In fact, it's our war job to do so. We are anxious to co-operate with you in any way you desire and to any degree that is helpful.

A letter to me at 20 North Wacker Drive, Chicago 6, Ill., will get an answer to any query you may wish to direct to us.

• TEXTILE RESEARCH FOR AUGUST

The policy adopted by the Rayon industry of offering certain important patents to other producers on liberal terms was prompted by recognition of the possibility that the production of inferior rayon by competitors could do more to hurt the use of rayon in the public favor, and so to hurt the owner of the patent, than any possible difference in financial returns would be worth. Experience has shown also that a successful patent not offered invites attack either legal or technical. In *Textile Research* for August, H. Wickliffe Rose discusses the experience of corporations in the use of patents and the factors to be considered in any reforms in order that the patent system may be enjoyed more widely in the advancement of the arts.

In evaluating the efficiency of a fabric treated with a water-repellent, the temperature of the water used in the tests is of extreme importance. Variations as large as 100 per cent may result from the ordinary differences in tap water temperatures. This issue describes an investigation undertaken to establish the relationship existing in the well known hydrostatic pressure tests.

New data in regard to infra-red drying of textiles are furnished by tests described in this issue. A commercial gas-fired generating unit was used for determining the influence of cloth weight and the effect of color on the effectiveness of drying. The effect of distance from the burner to the cloth was also studied.

This Year's War Bonds Are To WIN!

• BOOK REVIEWS •

The Industrial Cafeteria and Restaurant Worker's Manual. *By Milton A. Rosenfeld. (Restaurant Management Consultant). Published by the National Foremen's Institute, Inc., Deep River, Conn.* 1943. 108 *pages. Price* $1.25.

Since production must be maintained in our all out effort to win the war, it is essential that the army of workers in the factories be properly fed.

To provide better eating facilities for the worker is the aim of the plant cafeteria, and the server in a war plant lunch room is making a definite contribution to winning the war. This volume will prove valuable to those who have this responsibility.

There are twenty chapters upon different phases of the subject, and the book is recommended to all who either conduct or plan upon a plant lunch room.

Organic Chemistry Simplified. *Rudolph Macy, Ph.D.* 431 *pages,* $3.75. *Published by Chemical Publishing Co.* 1943.

When one departs from the field of elementary and descriptive organic chemistry, and endeavors to enter the realm of the more advanced aspects of the subject, he immediately finds that considerable knowledge of molecular structure; new ideas of valence; distinction between ionic and covalent molecules; and polar and non polar groups is necessary before a comprehensive understanding may be attained.

The first part of this book is devoted to a study of atomic structure, which will help the student materially in bridging over the gap which might otherwise exist.

Many chemists who studied organic chemistry some years ago, and not familiar with the more modern developments, will find a study of this book both profitable and interesting. Numerous diagrams, charts, and figures assist materially in a clarification of the subject.

The Microscope and Its Use. *Frank F. Munoz, Technical Consultant in collaboration with Dr. H. A. Charipper, Professor of Biology. New York University.* 334 *pages,* 122 *illustrations. Price* $2.50. *Published by the Chemical Publishing Co., Inc.* 1943.

In their endeavor to publish a technical book on the microscope in non-technical language the authors have been very successful. The book however is not so elementary as to lack interest and serve as a valuable reference for more advanced students.

As industry becomes more technically minded the microscope is being used more and more, not only in research but also in the routine work of the industrial laboratory. Observation has demonstrated that very frequently the efficiency and value of microscopic work is greatly depreciated, through lack of knowledge and inexperience on the part of those selected to use the equipment. This volume might well serve as the first to be studied by those who are assuming the responsibility of the use and manipulation of microscopes in such laboratories. Answers are given in clear and simple language to most of the questions which arise in the use of simple and specialized microscopes and their attachments. The thirty two page Glossary at the end of the book will be found very helpful.

ABSTRACTS OF PAPERS

to be Presented at Pittsburgh, Pa., September 6 to 10, 1943

Division of Cellulose Chemistry of the American Chemical Society

Thursday Morning and Afternoon

9:00—1. *Fibrillar Structure of High-Tenacity Rayon.* L. M. Welch and W. E. Roseveare, Viscose Rayon Research, E. I. du Pont de Nemours & Co., Richmond, Va.

SEVENTY per cent nitric acid has been used to aid in breaking down rayon filaments into fibrils, which can be seen with the optical microscope. A series of x-ray diffraction patterns and photomicrographs shows the effect of crystallite orientation on fibril formation in synthetic cellulose fibers. Rayons having high crystallite orientation show distinct fibrils, whereas unoriented rayon does not have a fibrillar structure. Natural and synthetic cellulose fibers, showing the same over-all crystallite orientation with respect to the fiber axis, may have a considerably different crystallite orientation in the fibrils since the natural cellulose fibers have the well-known spiral arrangement about the fiber axis.

9:30—2. *The Chemical Composition of Redwood Bark.* H. F. Lewis, F. E. Brauns, M. A. Buchanan, and E. F. Kurth, The Institute of Paper Chemistry, Appleton, Wis.

An extensive investigation has been carried out on the chemical composition of redwood bark. This investigation is particularly timely in view of the use of redwood bark fiber blended with other fibers for textile purposes and of the use being made of this fiber as an insulating material. In the commercial production of redwood bark fiber by The Pacific Lumber Co., the bark is separated into two products—bark fiber and bark dust—which are obtained in approximately equal yields. The fiber is used and the dust is burned.

Redwood bark fiber has been shown to contain cellulose and a lignin which is probably the same as the lignin in redwood and in spruce. In addition to these two common wood fiber components, there are at least two other products which appear as lignin in the lignin determination and a form of pectin. Small amounts of a catechol-type tannin and phlobaphene are also present.

The two materials in the bark which test as lignin have been characterized. They apppear to be high molecular weight phenolic acids. One, which is present in the greater amount, has alcohol hydroxide, phenol hydroxide, and carboxyl groups in the ratio of 2:4:3. The product contains no methoxyl. The second product is closely related to lignin but contains somewhat less methoxyl and a certain amount of carboxyl groups. The bark dust, which is made up of broken fragments of bark fibers as well as the small cells present in the bark and the dried fragments of cell walls of the parenchyma cells and sieve tubes, is even richer in the phenolic acid referred to above. A botanical study of the redwood bark has shown the presence of this compound in the cork cells and parenchyma cells of the bark. It also appears to line the cell walls of the fibers and other cell structures in the bark. The bark dust contains a larger amount of the pectin and a small amount of catechol tannin and phlobaphene. The phenolic acid component of bark dust and bark fiber is easily obtained by an alkaline extraction and acidification. Its possible use in chemical industry is discussed.

10:00—3. *The Reduction of Aromatic Nitro Compounds by Sulfite Waste Liquor.* Irwin A. Pearl and Harry F. Lewis, The Institute of Paper Chemistry, Appleton, Wis.

Recent literature has indicated the use of nitro-benzene and alkali as a means of converting lignin to vanillin. The present report includes an extensive study of the conditions necessary for the reduction of nitrobenzene by means of sulfite waste liquor and alkali. In this investigation the following variables have been considered: time of reaction, temperature, concentrations of reactants, order of reaction, and the nature of the sulfite waste liquor. The reaction mechanism has been rather thoroughly investigated and sodium *p*-azobenzenesulfonate has been identified as an important product of the reaction when carried out at atmospheric pressure. The mechanism for its formation in the reaction has been established. Other reduction products obtained in high yield, depending upon the conditions, are azoxybenzene, azobenzene, and aniline. Optimum conditions for the preparation of each of these in maximum yield have been determined.

In all of the experiments, vanillin has been obtained as a by-product from the simultaneous oxidation of the lignin in the sulfite waste liquor, and recoveries up to 25 per cent, based on the lignin, have been obtained. Material balances have been made on the nitrobenzene, lignin, and methoxyl entering into the reaction. The reuse of the desulfonated lignin resulting has been considered.

A number of other organic nitro compounds have been used in place of nitrobenzene and new products isolated. The nature and yields of these products obtained both at atmospheric pressure and above atmospheric pressure have been determined. Sulfite waste liquor is indicated as a good substitute for zinc dust in the preparation of a mixture of azoxybenzene and sodium azobenzenesulfonate for direct conversion to benzidine.

10:45—4. *Thermal Stability of Carbohydrates and Lignin.* Ernst Berl, Carnegie Institute of Technology.

With E. Weingartner the decomposition of cellulose and lignin in vacuum in presence of P_2O_5 at elevated temperature was studied. After a relatively long time of incubation with very low speed of decomposition, this speed increases suddenly and quickly. At least two or three different reactions are responsible for this quick decomposition of cellulose in a temperature interval of 120°-190°C.

Lignin poor in carbohydrates in the same temperature interval shows no decomposition. Cellulose containing lignin decomposes after a long incubation period. Then it behaves like pure cellulose. Addition of oxygen in this temperature interval does not influence the very slow decomposition of lignin.

With Regis Raab a great number of experiments were carried out with the glass feather manometer of Schaeffer and Treub. The heat stability of lower carbohydrates, of starch and cellulose, of inositol and mannitol, of lignin, lignin humic acids and artificially produced cellulose humic acids were also investigated in vacuum. There is a great difference in the stability of the carbohydrates. The most instable material investigated was fructose. Higher carbohydrates show increased heat stability. The highest stability was shown by cellulose.

The decomposition of carbohydrates is strongly influenced by the presence of its decomposition products, mainly carbon dioxide, volatile lower fatty acids, and water. The heat stability increases strongly when those decomposition products are absorbed by lime.

The heat decomposition of cellulose is strongly influenced by the amount of decomposing material per unit of volume (charging density). Increased charging density going parallel to pressure acts in the same way as increase in temperature.

Mannitol, a sugar alcohol, is more heat-stable than cellulose. Inositol, due to its symmetric structure, shows a much higher stability than cellulose.

Lignin, lignin humic acid, and cellulose humic acids decompose at much higher temperature than carbohydrates. This is due to their aromatic structure which already exists in cellulose humic acids.

This series of investigations has been carried out in order to get some insight into the geochemical formation of coals. The high reactivity of carbohydrates is essential for their geochemical conversion into coals, asphalts, and oils.

11:15—5. *The Action of Ultraviolet Light Upon Cellulose.* E. Heuser, Robert A. Stillings, and Robert F. Van Nostrand, The Institute of Paper Chemistry.

To study the action of ultraviolet light upon cellulose an apparatus was constructed which permitted the exposure of cellulose in powder form while it was continuously being mixed in a rotating chamber. In addition, provisions were made for evacuation and for flushing of all parts of the apparatus, including the cellulose sample, with the desired atmosphere and for continuous analysis of gaseous products liberated from the cellulose during irradiation.

Special stress was laid upon the removal of small quantities of oxygen left in commercial nitrogen and of air retained by the cellulose sample in order to study the action of ultraviolet light in the greatest possible absence of oxygen. Under these conditions, and with a strong ultraviolet light source and sufficiently long time of exposure, the cellulosic material was considerably degraded. This was indicated by a decrease in degree of polymerization and alpha-cellulose content and an increase in copper number, as well as by the liberation of carbon dioxide and carbon monoxide.

Whereas the first three changes are the result of the cleavage of glycosidic linkages, the indications were that the liberation of the gases did not result directly from this reaction. The behavior of glucose and cellobiose under irradiation in nitrogen made it seem probable that a second primary reaction was involved.

It is improbable that the traces of oxygen left in the cellulosic material and introduced by the nitrogen were responsible for the irradiation effects, and it seems safe to suggest that these effects are the result of a photochemical reaction. On the other hand, it was found that oxygen, if admixed to the nitrogen, increased the effects considerably. Since oxygen alone—without simultaneous irradiation—had no effect upon cellulose, and since no ozone was formed on irradiation, it would appear that irradiation causes the cellulose to become sensitive to oxygen. It is suggested that this sensitization is a result of the modification of glycosidic linkages in a way that they are ruptured by oxidation. The modification reaction seems to be related to the liberation of carbon dioxide and carbon monoxide.

That irradiation makes cellulose sensitive to oxygen is supported by the interesting observation that the degradation continued if the irradiated cellulose was stored in air or oxygen, but ceased if air or oxygen were replaced by nitrogen. Indeed, the degradation effect could be produced or arrested *ad libitum*, depending upon the choice of atmosphere.

However, if air or oxygen was present during irradiation, the postexposure effect was diminished. If sufficient oxygen was present during irradiation for a sufficiently long time, the postexposure effect practically ceased to occur. Under these conditions, the degree of polymerization of cotton linters decreased from 1400 to a final value of 272, but, no doubt, could be reduced still further.

1:30—6. *Fractionation of Cellulose. The Summative Distribution Curve.* S. Coppick, New York State College of Forestry, Syracuse, New York, and O. A. Battista and M. R. Lytton, American Viscose Corp., Marcus Hook, Pa.

A process for the fractional analysis of cellulose is described. The method involves fractional precipitation from an alkaline solution. Amounts of material having a degree of polymerization between 0 and η are determined for various values of η. The weight average degree of polymerization for each of these fractions is determined and the results give a plot which is the "summative" distribution curve. The mathematical interpretation of this curve is explained as well as its relation to the more common "integral" and "differential" distribution curves.

Results are given for a typical rayon cellulose and this material is used as an example for the conversion of the "summative" curve to the more common representations of heterogeneity in polymers.

1:50—7. *Fractionation of Cellulose. Poly-degradation in the Viscose Process.* S. Coppick, New York State College of Forestry, Syracuse, N. Y., and O. A. Battista and M. R. Lytton, American Viscose Corp., Marcus Hook, Pa.

The distribution of molecular sizes in rayons is considered on a statistical basis. The ideal case for a uniform pulp and a homogeneous degrading reaction is worked out to give theoretical summative distribution curves.

The heterogeneity of commercial pulps is taken into account as well as the nonuniformity of the degrading reaction, to give theoretical distribution curves for rayons which agree with those obtained experimentally from various wood pulps and cotton linters.

An experimental procedure is given for the fractionation of rayon yarn.

The results indicate that the distribution of chain lengths in a viscose is related to the spinning properties of that viscose.

2:10—8. *Fractionation of Cellulose. Wood Pulps and Cotton Linters.* S. Coppick, New York State College of Forestry, Syracuse University, Syracuse, N. Y., and O. A. Battista and M. R. Lytton, American Viscose Corp., Marcus Hook, Pa.

A method is described for the fractional analysis of wood pulps and cotton linters.

Summative distribution curves are given for high and low viscosity wood pulps, overbleached wood pulp and cotton linters. The distribution of chain lengths in the original pulp is shown to have a pronounced effect on the distributions for the rayons prepared from these pulps.

2:45—9. *Elasticity, Creep and Recovery of Rayon Yarns.* Jack Press and H. Mark, Polytechnic Institute of Brooklyn.

Flow and recovery curves of commercial viscose and acetate rayon yarns were investigated over a period from 10^{-1} to 10^{6} seconds; the stresses varied between 0.1 and 0.7 gram per denier.

It was first attempted to represent the experimental curves point by point numerically with the aid of an equation containing:

An instantaneous elastic extension, the modulus of which was taken from the velocity of propagation of sound or ultrasonic waves (moduli are around 8×10^{10} dynes per sq. cm.)

One or two delayed elastic contributions, having smaller moduli (around 10^{10}) and times of retardation between one-tenth and fifty seconds.

A term representing viscose flow, having viscosities above 10^{8} poises.

In most cases, it was necessary to add a term proportional to the logarithm of time.

It was then attempted to correlate the above contributions to different elementary molecular processes, which contribute to the elongation of the yarn:

The instantaneous elasticity seems to be due to the stretching of van der Waals bonds or hydrogen bridges.

The delayed elasticities can be ascribed to the uncoiling and straightening of curled and kinked chains in the disordered areas of the samples.

Viscose flow seems to indicate slippage of straightened out chains along each other.

The logarithmic creep can be correlated with phase transitions during the stretching process.

The above correlation must be considered to be a tentative working hypothesis, which needs further experimental check and theoretical refinement.

(Concluded on Page 394)

DEVELOPMENTS IN MORDANTING*

Polymerized Products and Resins as Binding Agents

ONE of the most interesting developments of modern times is the ever-widening use of complex organic substances in the textile industry and not least interesting among these uses is that of substances to take the place of the inorganic mordants favored by the dyer and printer of earlier days. To-day all kinds of synthetic polymerized products and resins are being pressed into service of the colorist for the purpose of binding dyes to textile materials. This is a trend which would appear to mean the abandonment ultimately of many assistants which have been much used in the past.

MANY DYES WITHOUT AFFINITY

In reviewing the various coloring matters now available it is seen that a large proportion of them have no affinity for at least one of the textile fibers now in use. For example, the acid dyes are quite suitable for application to silk and wool because they have a strong affinity for these fibers. On the other hand, these same dyes usually resist cotton and cellulose rayons—there is a complete lack of affinity. Again, acetate rayon dyes seldom dye cotton. In contrast, direct cotton dyes generally leave acetate rayon absolutely unstained.

Of the total number of dyes now in common use, about one-half are applicable only to one fiber. This is a big disadvantage to the dyer, for it frequently happens that the brilliance of shade and fastness properties of a dye are excellent but that it cannot be applied to the textile material being processed because there is no affinity between them.

These relationships between dyes and textile fibers brought about the necessity for employing third substances capable of binding a dye to a textile material so that the resulting shade would be fast to normal influences.

In the past, considerable use has been made of inorganic binding agents—usually termed mordants. Thus wool is frequently chromed in order that it may have the required affinity for azo and other dyes. In some processes of printing, cotton fabrics are first treated with aluminum acetate so that the cotton may have an affinity for dyes which otherwise could be applied only to wool and silk. The use of tannic acid for giving cotton an affinity for basic dyes is well known.

But the use of these inorganic mordants is attended by disadvantages. The handle of the textile material is often adversely influenced. For example, chromium mordants give real silk a harshness which will not be tolerated. Antimony tannate mordant on cotton also confers harshness on this fiber. But the harmful effect of these mordants has been most noticed with the various rayons, so that the use of a mordant on these materials is avoided if at all possible.

Yet there is still the necessity for mordants or binding agents to make more dyes suitable for application to more fibers.

It is in this connection that the newer synthetic organic substances are beginning to find important uses. They have the prime advantage of being flexible in use and when applied in a suitable manner they do not confer harshness or stiffness on the textile material. Furthermore, these newer products have great stability—they retain their original white color and are usually resistant to acids and alkalis such as may be applied to textile materials.

The idea of using organic mordants can be traced to the use of sufurized phenols, such as Katanol. These substances, formed by digesting phenol and sulfur (often in the presence of iodine as catalyst) have a direct affinity for cellulose fibers so that these are then able to attract and fix basic dyes. It is true that polymerized fats and oils had been used previously but these always had to be fixed themselves by mineral salts. In the case of the sulfurized phenol products no metal is necessary. Thus the handle of the textile material mordanted with them is never adversely affected.

UREA-FORMALDEHYDE RESINS

Later it was discovered that urea-formaldehyde resins applied to textile materials of all kinds could give these an affinity for various dyes according to the manner in which the resin was produced. In particular, these resins enabled cotton and similar fibers to be dyed with acid wool dyes and also with basic dyes, the use of a metal mordant being thus made unnecessary.

Subsequently research has been directed towards the use of alternative resins so as to secure better results. It may be noted that melamine-formaldehyde and dicyandiamide-formaldehyde resins have been favorably mentioned in this field, and the latter resin is stated to be utilized in the manufacture of Rayolanda X—the Courtauld rayon made from cellulose but having wool dyeing properties.

More recently, synthetic polyamides, such as are used for the manufacture of nylon, have been applied to fibers of the cellulose type to give these an affinity for basic and acid wool dyes. These polyamides are closely allied to wool keratin in composition and molecular structure so that it is easy to understand their usefulness for this purpose.

*Reprinted from The Dyer and Textile Printer (England).

But on the other hand, such substances are expensive and so far they have proved difficult to fix in cotton and other materials. Ordinary methods of deposition from a solution have yielded non-cohesive films. Yet the problem is steadily being overcome so that in the future it is likely that these polyamides will be used as fixatives to assist the dyer.

Thus there is a general tendency to displace the older mineral mordants by these newer organic substances. But the method of application remains the same—pre-treatment of the textile material with the organic substance so that it can then be dyed. Thus it becomes more interesting to examine how far these mordants or "third-party" substances can be used rather as binders instead of attractors of dyes.

It would be simpler if these organic substances could be used to cement or bind the dye particles to a textile material rather than that they should confer on the material an affinity for dyes not otherwise applicable. For then, only the binding qualities would come into consideration—it would not be necessary for the organic substance to have an affinity either for the textile material or for the dye. A wider range of products could thus be utilized.

THE "ARIDYE" METHOD

The American "Aridye" method of coloring textiles is based on this principle. Synthetic resins are used. Fabrics are printed with dye pastes containing as an essential ingredient a partly formed urea-formaldehyde resin or the components of any other suitable resin. The fabric is later subjected to a treatment, usually at a high temperature, which completes formation of the resin so that this then binds the dye particles to the fabric. It is found that excellent colorings on all types of textile material can be secured in this way. Such colorings also have a high degree of fastness to washing.

It seems that this idea—an extension of the simple mordanting operation—has much greater possibilities now that synthetic organic substances are available as binders. Hitherto, the dyes which can be applied to textile materials in dyeing and printing, have been restricted by the necessity that they shall have a strong affinity for the textile material. This has entailed avoiding the use of many coloring matters (mainly pigments insoluble in water) which have excellent fastness properties. It is now envisaged that one line of progress in the dyeing industry will be that of discovering and utilizing synthetic agents whereby the importance of dyestuff affinity for the textile material will be largely discounted.

This Year's War Bonds are to WIN!

Abstracts—

(Concluded from Page 392)

3:15—10. *Cupriethylene Diamine as a Solvent for the Precise Determination of Cellulose Viscosity.* R. S. Hatch, Weyerhaeuser Timber Co.

Cuprommonium hydroxide solutions have long been used as dispersing agents in the determination of viscosity. If reproducible results are to be obtained by the use of cuprammonium solvent, it is necessary to observe the greatest precautions to exclude even traces of atmospheric oxygen. Long experience with cupriethylene diamine as a dispersing agent has shown that it is very much less sensitive to traces of oxygen than is the case with cuprammonium solvent and that reproducible results may be obtained with far less effort and with less equipment than is required when working under the conditions imposed by the present standard method of viscosity determination. Cupriethylene diamine as a solvent is also readily adapted to a rapid method for plant control purposes. A complete viscosity determination of sufficient accuracy for plant control purposes may be completed in thirty minutes time.

The method has been rigorously compared with the A.C.S. tentative standard method and a correlation curve showing the relationship between viscosities determined on a 1 per cent cellulose dispersion in cupriethylene diamine solvent and a 2.5 per cent cellulose dispersion in cuprammonium solvent is presented.

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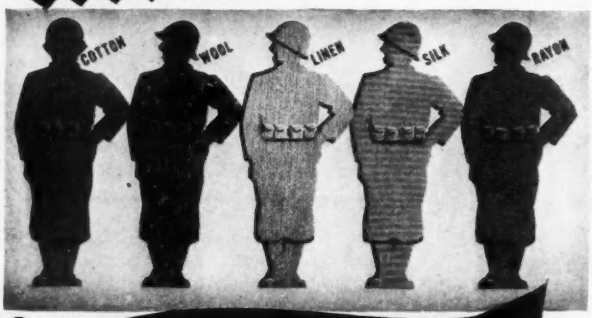

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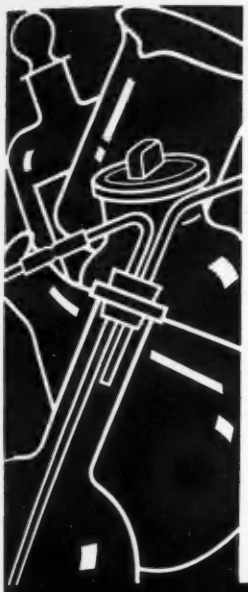

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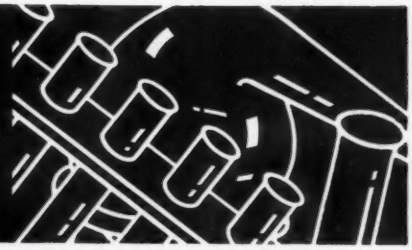

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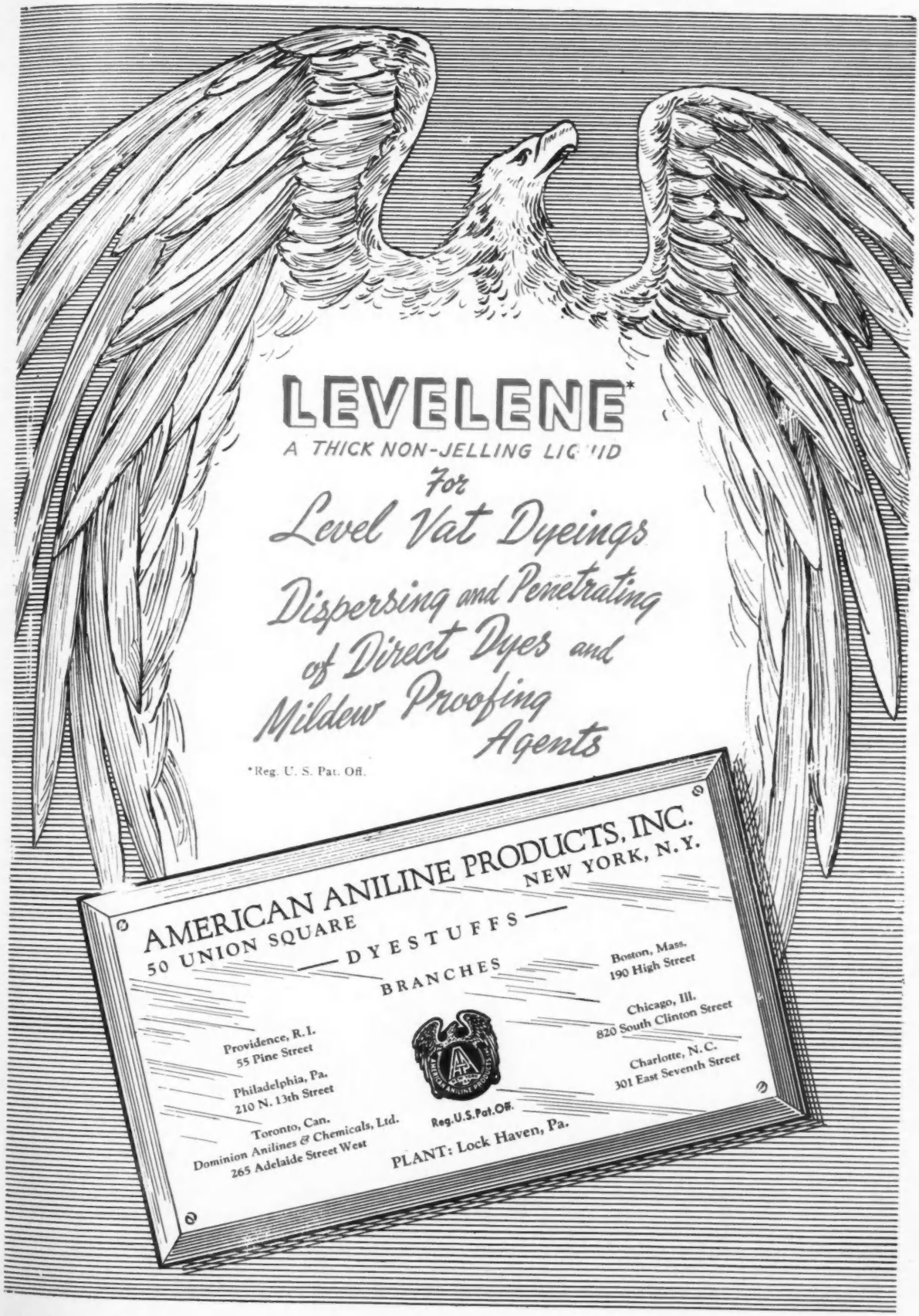
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